Analysing the emergence of risk

- an opportunity for patient safety

Svensson, Jakob

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JAKOB SVENSSON
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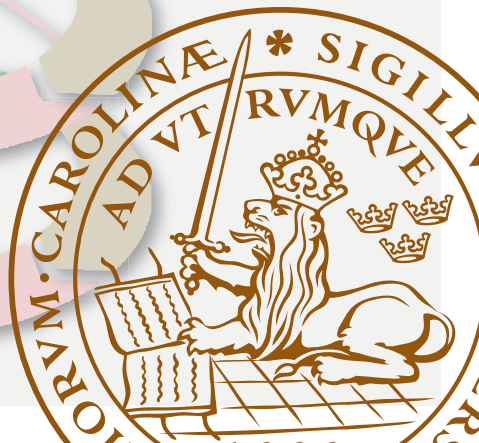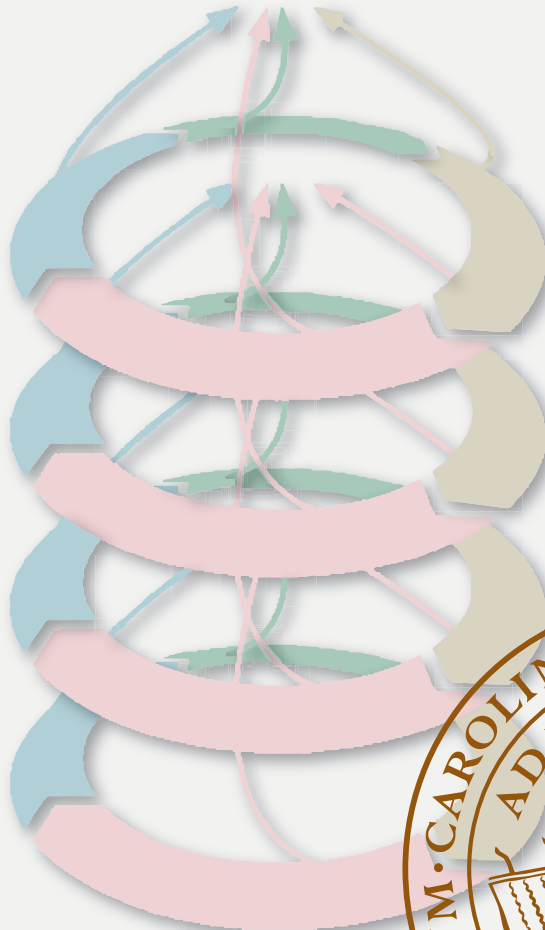
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Analysing the emergence of risk – an opportunity for patient safety

Abstract

The notion of patient safety entails protecting patients from preventable harm. This thesis presents suggestions on how the healthcare system, notably psychiatric healthcare, can understand and analyse patient safety risk as an emergent property of everyday interactions and relations. This view has its conceptual roots in complexity theory.

The overall aim is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach. Four studies are presented, and two main research questions are asked.

The first research question is addressed through a scoping review, and the second (along with three sub-questions) uses a psychiatric clinic as a case study to analyse patient visit patterns over time. This thesis suggests that increased patient safety requires an understanding of interactions between multiple system levels, with a focus on how risk emerges from performance variability, adaptive capacities and changing conditions over time. It proposes new methods for analysing and interpreting dynamic emergent risk in psychiatric healthcare.

The methods used in Paper II, III, and IV illustrate how patient visit patterns can be used to analyse emerging risks in the healthcare system. The results help to create an understanding of how patient safety risk is dynamic and changes over time. Overall, the thesis provides a conceptual framework for mapping sources of adaptive capacities and performance variability, together with the risk emerging from their interactions. This knowledge can be used to create new forms of feedback from the meso to the micro level (e.g. via electronic medical records), which, in turn, could increase patient safety.

Key words
Patient safety, Psychiatry, Risk, Emergence, Performance variability, Adaptive capacities

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Jakob Svensson

LUND
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Table of Contents

Abstract

The notion of patient safety entails protecting patients from preventable harm. This thesis presents suggestions on how the healthcare system, notably psychiatric healthcare, can understand and analyse patient safety risk as an emergent property of everyday interactions and relations. This view has its conceptual roots in complexity theory.

The overall aim is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach. Four studies are presented, and two main research questions are asked:

Research question 1: How does the current construct of patient safety in psychiatry reflect contemporary safety science?

Research question 2: How can we understand emergent risk at the meso level, based on patient visit patterns to a psychiatric healthcare facility?

The first research question is addressed through a scoping review, and the second (along with three sub-questions) uses a psychiatric clinic as a case study to analyse patient visit patterns over time. This thesis suggests that increased patient safety requires an understanding of interactions between multiple system levels, with a focus on how risk emerges from performance variability, adaptive capacities and changing conditions over time. It proposes new methods for analysing and interpreting dynamic emergent risk in psychiatric healthcare.

- Paper I discusses how patient safety is described within the psychiatric literature, and links it to contemporary safety research on complexity. The results show that patient safety work within psychiatric care largely aims to prevent specific risk situations through efforts to limit or reduce them, often through increased standardization.

- In Paper II, emergent risk is analysed from an organizational perspective. Outpatient visit patterns are viewed as a source of system

adaptability. The results show that patients' actual healthcare visits can differ from the system's expected visits.

- In Paper III, mortality risk factors for the patient are analysed based on gender, type of diagnosis, number of diagnoses, and number of visits to an emergency ward for substance use. The results show that patients' previous interactions with healthcare can be used at the system level to identify an emergent risk for increased mortality.

- Paper IV uses a mixed methods approach. It draws upon patient visit patterns and a focus group to portray patient safety risk in an emergency ward for substance use. The results show emergent risk patterns in stressful conditions linked to overcrowding or bed shortages. It proposes a supportive management tool that can detect the expected workload.

The methods used in Paper II, III, and IV illustrate how patient visit patterns can be used to analyse emerging risks in the healthcare system. The results help to create an understanding of how patient safety risk is dynamic and changes over time. Overall, the thesis provides a conceptual framework for mapping sources of adaptive capacities and performance variability, together with the risk emerging from their interactions. This knowledge can be used to create new forms of feedback from the meso to the micro level (e.g. via electronic medical records), which, in turn, could increase patient safety.

Svensk sammanfattning

Patientsäkerhet betyder skydd mot vårdskada. Avhandlingen lyfter fram förslag på hur hälso- och sjukvården, och psykiatrin i synnerhet, kan förstå och analysera hur risk uppstår som en framväxande (eng. emergent) egenskap.

Traditionellt har hälso- och sjukvården antagit ett perspektiv som syftar till att identifiera bakomliggande orsaker till en vårdskada och därefter sätta in åtgärder för att förhindra att liknande händelser inträffar. Det traditionella angreppssättet karakteriseras vanligtvis av ett fokus på avvikelser och brister, där sjukvårdssystemet i sig själv ofta betraktas som 'säkert'. I ett sådant sammanhang kan begreppet risk uttrycka en sannolikhet för att en vårdskada ska inträffa och risk kan också uppfattas som något objektivt.

Modern patientsäkerhetsforskning lyfter fram patientsäkerhet som en framväxande egenskap där vårdskador kan uppstå som ett resultat av gradvis förändrade tillstånd, som till exempel ökad arbetsbelastning. I avhandlingen föreslås att ökad patientsäkerhet utifrån ett systemperspektiv, kräver förståelse för interaktioner på flera nivåer, inklusive lokala variationer och förändrade förhållanden. Avhandlingen bidrar med nya metoder för att analysera och tolka framväxande risker inom hälso- och sjukvård med fokus på psykiatrisk vård.

Syftet med avhandlingen är att förstå patientsäkerhetsrisker som en framväxande egenskap, och hur risk kan analyseras genom patientbesök till en psykiatrisk vårdinrättning, baserat på ett holistiskt synsätt.

Fyra delstudier presenteras där studie I, som utgörs av en litteraturstudie, skildrar hur patientsäkerhet beskrivs inom den psykiatriska litteraturen. Studie II, III och IV utgörs av fallstudier som analyserar mönster av patientbesök och hur dessa mönster gör att patientsäkerhetsrisker kan upptäckas på systemnivå.

- I studie I diskuteras hur patientsäkerhet beskrivs inom den psykiatriska litteraturen. Därtill dras paralleller till nutida säkerhetsforskning om komplexitet. Resultatet visar att patientsäkerhetsarbetet inom den psykiatriska vården till stor del arbetar förebyggande genom att begränsa eller reducera specifika risksituationer, ofta genom ökad

standardisering. Patientsäkerhetsrisker beskrivs sällan som något som förändras över tid.

- I studie II skildras risk utifrån ett organisatoriskt perspektiv, där mönster i patientbesök inom öppenvård kan ses som en källa till anpassning av sjukvårdssystemet. Resultatet visar att patienters faktiska vårdkontakter kan skilja sig från sjukvårdssystemets förväntade vårdkontakter.

- I studie III analyseras riskfaktorer för ökad mortalitet utifrån kön, typ av diagnos, antal diagnoser och antal besök till en psykiatrisk akutmottagning. Resultatet visar att patienters tidigare interaktioner med vården kan användas på systemnivå för att identifiera en ökad risk för tidig död.

- I studie IV används både patientbesöksmönster och en fokusgrupp för att skildra patientsäkerhetsrisker på en vårdenhet. Resultatet visar hur risker kan uppstå över tid och kan få konsekvenser i form av överbeläggningar, vilka till en viss del kan förutses. Resultatet skulle kunna underlätta planeringen av vården och därmed stärka patientsäkerheten.

De metoder som används i studie II, III och IV utgör exempel på hur mönster av patientbesök kan användas för att analysera framväxande risker inom hälso- och sjukvården. De resultat som presenteras föreslås kunna skapa en ökad förståelse kring hur patientsäkerhetsrisker kan ses som framväxande egenskaper som förändras över tid. I avhandlingen visas hur system kan anpassas utifrån lokala variationer samt hur risker kan upptäckas från interaktioner över tid. Därmed uppstår också möjligheten att, genom till exempel det elektroniska journalsystemet, förbättra återkopplingen av patientsäkerhetsrisker och på så vis förbättra förutsättningarna för en säkrare vård.

List of papers

The thesis is based on the following papers, which form the appendix, and are referred to as Papers I–IV.

Paper I

Patient Safety Strategies in Psychiatry and How They Construct the Notion of Preventable Harm: A Scoping Review.

Svensson, J. (2022). *Journal of Patient Safety* 18(3), 245–252.
DOI: 10.1097/PTS.0000000000000885

Author's contribution: Jakob Svensson conceptualized the study design and performed the collection of data. He analysed and interpreted the data and had ongoing discussions with supervisor Johan Bergström. Svensson then wrote a first draft of the manuscript for Bergström, who contributed comments based on his expertise and his role as supervisor.

Paper II

Visualizing healthcare system variability and resilience: a longitudinal study of patient movements following discharge from a Swedish psychiatric clinic.

Svensson, J., Bergström, J. (2020). *BMC Health Serv Res* 20, 787.
DOI: 10.1186/s12888-022-04437-6

Author's contribution: Jakob Svensson and Johan Bergström conceptualized the study design and Svensson contributed to the collection of data. Both Bergström and Svensson performed the data analysis and interpretation, Svensson then drafted the first version of the manuscript for Bergström, who contributed revisions based on his expertise.

Paper III

Patterns of mortality risk among patients with substance use disorder: an opportunity for proactive patient safety?

Author's contribution: Jakob Svensson, Per Becker and Johan Bergström conceptualized the study design, and Svensson contributed to the collection of data. Becker produced the figures and tables and, together with Svensson did the statistical analysis. Becker, Svensson and Bergström contributed to the interpretation of the data, and Svensson then drafted the first version of the manuscript. This was read by Bergström and Becker, who contributed revisions based on their expertise. Martin Kåberg then read the manuscript; he contributed some final revisions and supplemented it with medical views on the treatment of patients with substance use disorder.

Paper IV

Evaluating patient safety pressure on an emergency ward for substance use: a case study using mixt-methods sequential explanatory design

Svensson, J. Manuscript submitted for publication

Author's contribution: Jakob Svensson conceptualized the study design and performed the collection of data. He analysed and interpreted the data, and had ongoing discussions with supervisor Johan Bergström. Svensson then wrote a first draft of the manuscript for Bergström, who contributed comments based on his expertise and role as supervisor.

Prologue

After seven years of working as a patient safety investigator at a psychiatric clinic, I have come to question the relevance of single-case error investigations. As an insider in psychiatric healthcare, my experience has made me doubt whether the established methods that are used to prevent or mitigate accidents in healthcare are adequate. Talking about individual cases as if they were unique events seems to have limited value. Over time, I realised that there were unexplored patterns and factors behind an accident, and I wanted to understand if, and how, the healthcare system creates conditions for failure.

The healthcare nomenclature is rooted in scientific theories. In this domain, cause and effect relationships are typically understood as symmetrical, and based on a deterministic epistemology. While unpredictability creates new challenges for patient safety, patient safety research has increasingly embraced uncertainty and complexity. This thesis will examine the framework of patient safety through the lens of psychiatric healthcare. Patient safety will be discussed on a meso level (i.e. from the perspective of a psychiatric clinic). It will not elaborate on the technical skills of individual front-end workers, nor the consequences of insufficient patient safety management or patient suffering. Instead, it advocates for better patient safety management, and seeks to contribute new perspectives on how to understand and evaluate patient safety prerequisites.

I hope that this thesis is seen as a contribution to the patient safety literature, and will inspire healthcare managers to grasp the opportunities that lie within the healthcare system to enhance patient safety. The methods used in this thesis is to understand how the healthcare system itself can make it easier for those within it – both patients and front-end staff. This thesis is for them.

Introduction

Swedish legislation gives the following definition of what constitutes patient harm: suffering, physical or mental injury or illness as well as death that could have been avoided if adequate measures had been taken during the patient's contact with the healthcare system (Swedish Government, 2010). According to the country's National Board of Health and Welfare, 100,000 patients suffer from these unintended injuries each year in somatic healthcare, which is equivalent to 10% of all healthcare visits (Socialstyrelsen, 2021). Although it can be difficult to determine the prevalence of patient harm due to the broad definition, the Swedish Association of Local Authorities and Regions (SALAR) published a report on injuries in psychiatric healthcare in 2020. The report investigated 3,341 "healthcare episodes" using a Global Trigger Tool. An injury was identified in 11.4% of all cases, and only 4.6% were identified as preventable, in other words, as patient harm (SALAR, 2021a).

Patient safety is traditionally defined as the absence of preventable harm, and a reduction in the risk of unnecessary harm (WHO, 2020). When seeking healthcare, one assumes that the treatment will proceed as planned, and that all of the actions that are taken will bring the patient closer to the overall aim of reducing the illness for which healthcare was originally sought. This would indeed be the case if it were not for those healthcare actions which themselves cause patient harm. The traditional definition of patient safety therefore refers to an absence of actions that lead to patient harm, and interventions seek to limit such actions. However, an alternative way of looking at patient safety is not as the *absence* of patient harm, but the *presence* of safety strategies and adaptive capabilities. Such a standpoint can be distinguished from a perspective that sees humans as the weak link, and human error as an explanation for accidents. Instead, it introduces the notion that 'human error' is socially constructed (Dekker, 2019; Woods et al., 2010).

In the Swedish context, it appears that the healthcare system puts all of its patient safety eggs in the same basket—accident investigation—and misses an opportunity to use supplementary data to understand how risk and safety emerge. Although accident investigation in healthcare usually aims to find the

causes underlying the accident, the objectivity of these investigations has been questioned (Lundberg, Rollenhagen, & Hollnagel, 2010). Although two investigations of the same accident can end in different conclusions, these exercises could serve an epistemological, preventive, moral and existential sense-making purpose for patients and front-end workers (Dekker, 2015). Answers to questions regarding how and why something happens can give a feeling of closure. Even though almost 40 years have passed since explanations based on 'human error' were first questioned (Reason, 1990), the complexity of modern healthcare means that patient safety investigations still face challenges. Assumptions that rational choices were made in the lead-up to an accident, which imply an immoral calculation of costs and benefits, or that violations were conscious, continue to be prevalent (Amalberti, Vincent, Auroy, & de Saint Maurice, 2006; Dekker, 2014b; Woods et al., 2010). While it might seem obvious that people do not *choose* to fail, this point is important given that the likelihood of failure could increase in the face of increasing demand for healthcare over time, and insufficient resources to keep up (Hollnagel, Woods, & Leveson, 2006).

Emergency departments are part of a healthcare system that has endured long periods of changing demand and uncertainty. They are a particularly useful opportunity to study patient safety from an organizational point of view, together with issues such as how we can create conditions for success, and how pressures such as overcrowding, long stays and unpredictable events impact the quality of care (Hollnagel, Nemeth, & Dekker, 2008; Stephens, Woods, & Patterson, 2015; Wears, Perry, & McFauls, 2007). Fortunately, due to the healthcare system's ability to register data such as patient visits and illnesses, along with actions such as recording quality markers (Wears & Sutcliffe, 2019), there is an opportunity to study changing conditions (and risk) over time. In this thesis, my goal is to investigate dynamically changing risk landscapes in the context of psychiatric healthcare, based on retrospective data on system variability. Therefore, the overall aim is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach.

Outline of the thesis

In the Background section, I frame the general concept of patient safety, what it means and how different perspectives can impact our understanding of it. I also introduce the Swedish legislation that has guided my professional work in patient safety, and introduce two theoretical perspectives of safety.

In the Conceptual framework section, I present my understanding of risk and safety in psychiatric healthcare, and introduce how this has influenced my research. The Methodology and Results sections describe my original research, and I synthesize the outcomes of my papers in a general discussion (Discussion section) of how patient safety in psychiatry can be improved.

Background

The concept of patient safety

While patient safety is driven by the natural motivation to prevent something unwanted from happening again, it has historically been guided by hindsight (Woods & Cook, 2002). Knowledge of the outcome of an event impacts our understanding of what happened in the past; moreover, if we already know what happened, we tend to view the outcome as more probable (Woods et al., 2010), a phenomenon that is called 'outcome bias' (Baron & Hershey, 1988). When discussing patient safety, this is an important aspect to keep in mind. The Swedish National Board of Health and Welfare uses one, fundamental characteristic when defining patient harm, and this characteristic is evident in international patient safety policies (Panagioti et al., 2019; Socialstyrelsen, 2011): the notion of *preventability*. If a patient is injured (patient harm), and this injury could be avoided if adequate actions had been taken, the harm is considered preventable (Swedish Government, 2010). In other words, in order to be classified as patient harm, the preceding adverse event or injury must be judged to have been preventable. This determination is made if an error is judged to be identifiable and modifiable (Nabhan et al., 2012), or if a process resulted in failure, with the presumption that an error occurred somewhere in the healthcare process or its management (Wears & Sutcliffe, 2019). In a large-scale review and meta-analysis of hospital adverse events in different countries, 53% were considered preventable (Sauro et al., 2021).

However, as both technical and scientific progress has impacted healthcare, the definition of patient harm and patient safety has shifted. For instance, in the 1980s, healthcare-associated infections were regarded as unfortunate but inevitable (Vincent & Amalberti, 2015), but they are now considered as preventable. Another example is that the World Health Organization (WHO) now states that if good hand hygiene and other cost-effective practices are followed, 70% of healthcare-associated infections can be prevented (WHO, 2022). In retrospect, what we thought was non-preventable is now considered

preventable, and vice-versa (Vincent & Amalberti, 2015). Such changes are partially due to who has the mandate to define preventability (Dekker, 2009).

Over the years, modern healthcare has become increasingly standardized, and a focus on the quality of work has improved efficiency (Vincent & Amalberti, 2016). Until the 20th century, the assumption was that safety could be maintained if humans followed the rules and regulations. Consequently, we needed 'safe systems' that could protect us from unreliable humans (Hollnagel et al., 2006) and it became important to understand how these boundaries could be maintained (Hollnagel et al., 2006). Despite rapid developments in healthcare, the patient safety epistemology has largely remained unchanged; for example, 'human error' is still largely understood to be the cause of patient harm (Woods et al., 2010). Underlying this conclusion is the idea that healthcare is regarded as 'safe' by design, while human actions and adaptability are seen as a source of unreliability and risk (Woods et al., 2010). This epistemology of a fundamentally 'safe' healthcare system implies that patient harm can be reduced to zero, and directs the focus of safety management towards limiting and mitigating 'errors' (Cook, Render, & Woods, 2000; Woods et al., 2010). Once again, safety is seen as the absence of errors which lead to patient harm.

An alternative view, found in the patient safety literature, is that patient harm is generated if conditions are overwhelming and front-end workers' ability to detect and adjust to the increasing pressure is impaired (Cook et al., 2000; Hollnagel, Wears, & Braithwaite, 2015). Although there is no single general definition of preventable harm in healthcare (Nabhan et al., 2012), adverse events happen even if front-end workers do their regular job in ordinary situations (Dekker, 2019); in other words, they are the product of normal work. Normal work is characterized by the adaptive abilities of individuals who have a limited degree of freedom. Hence, there is a need to understand system variability in healthcare, and methods to monitor risk over time. History has shown us that no matter how hard we try to design safer systems, accidents continue to occur (Kellogg et al., 2017; Rasmussen, 1997).

Swedish legislation on patient safety

The WHO's Global Patient Safety Action Plan focuses on eliminating patient harm in healthcare, and has a vision of "a world in which no one is harmed in health care, and every patient receives safe and respectful care, every time, everywhere" (WHO, 2021 p.viii). The overall goal for patient safety in Sweden has adopted a similar vision of patient harm in healthcare, stating that *no patient should suffer from patient harm* (Socialstyrelsen, 2021). To reach this goal, the country's National Board of Health and Welfare highlights five key areas for increased patient safety. These areas are based on what are considered to be the main challenges between 2020 and 2024 (Socialstyrelsen, 2021):

1. Increase knowledge about patient harm that have occurred.
2. Reliable and safe systems and processes.
3. Safe healthcare here and now.
4. Strengthen analysis, learning and development capacities.
5. Increase risk awareness and preparedness.

However, information on factors that affect patient safety can come from various sources; as this enables an analysis of connections, trends, and measurement patterns, any results provide a more realistic presentation of the event (Socialstyrelsen, 2021). Patient safety investigations should present a representative picture of what happened, and why.

Swedish legislation on patient safety requires that healthcare (including psychiatry) investigations after an adverse event clarify the sequence of events leading up to the patient harm, and the causes behind it (a root cause analysis). This is achieved by asking 'why' five times, to reach the 'root cause' (SALAR, 2015). The investigation must then provide a basis for decisions on measures to prevent a similar event from happening again, or limiting the effects of a future event if it cannot be completely prevented (Swedish Government, 2010). Post-investigation, the healthcare provider must implement appropriate measures, create a follow-up procedure, and disseminate knowledge of the investigation within the healthcare system (SALAR, 2021b; Socialstyrelsen, 2017).

The methodology underlying patient safety investigations in Swedish healthcare originates from the 1990s. James Reason (1990) developed a

method to examine adverse events as the result of a chain of events. It prescribes an analysis of the actions taken by those involved, then a focus on the conditions and organizational context in which healthcare professionals were working (Reason, 1990). The key idea is that interventions need to be made at a high level in the organization if overall safety is to be improved. Subsequent studies suggested that individual education and disciplinary measures would not be sufficient (Vincent, Stanhope, & Taylor-Adams, 2000). Although this root cause approach to adverse event investigation is widespread in healthcare settings, it has been critiqued, as the frequency of certain types of incidents does not seem to have been reduced, nor do the proposed solutions appear to be reliably effective or sustainable (Fröding, 2022; Kellogg et al., 2017; Wrigstad, 2018). Similar criticism has emerged when using the 'five whys', as this method is open to oversimplification, and there is an assumption that the fifth step is always the most effective point to intervene (Card, 2017).

Swedish legislation seems to have adopted a traditional view of patient safety, notably the idea that a root cause can be found. In contemporary safety science, the belief is that accidents occur when ordinary people do their ordinary work in ordinary, complex and uncertain situations (Dekker, 2019). This means that we must understand what these ordinary situations look like, otherwise there is a risk of hindsight bias. There seems to be an assumption in healthcare that safety can be maintained if human performance stays within given boundaries, and that the otherwise 'safe' system should be protected against unreliable people (Hollnagel et al., 2006). However, people do what seems to be logical at the time, otherwise they would have done something else (Dekker, 2019). While current legislation demands certain types of patient safety investigations, *The Swedish Action Plan for Increased Patient Safety* provides an opportunity for healthcare providers to use new methods when analysing risk (Socialstyrelsen, 2021). In the following subchapter, I will elaborate on traditional and contemporary views of safety.

Two contrasting views on safety

"Safety is created through proactive resilient processes rather than through reactive barriers and defenses"

(Hollnagel & Woods, 2006, p.3)

A reductionistic approach

Reductionism is the belief that complex systems, phenomena or concepts can be explained by breaking them down into simpler or more fundamental components. It is the idea that a complex system can be understood by reducing it to its constituent parts and studying those parts separately. Such an approach assumes linearity, and while decisions are often guided by an impression of best practice in healthcare, it has not been demonstrated to improve patient safety (Leape, Berwick, & Bates, 2002). The reductionist approach is often used in the natural sciences, such as biology and physics, to explain complex phenomena by analysing the behaviour of individual atoms or molecules. Reductionism can also be applied to other fields, such as psychology and sociology, where complex systems are understood by analysing the behaviour of individuals or smaller groups.

In healthcare, a reductionistic view can increase bureaucratization, notably more guidelines, rules and hierarchy, often driven by legislation (Dekker, 2014a). It implies that it is possible to define 'the best way' to carry out a task, and creates an analytical root-cause approach, justifying preventability. The traditional way of managing patient safety is then characterized by a focus on deviations from the norms of an inherently static 'safe' system. Such deviations are typically defined as 'errors' and safety management efforts are dedicated to restricting the actions of front-end workers through more procedures and well-defined processes (Wears & Sutcliffe, 2019). The understanding of the system is based on a reductionist principle which states that the functioning of the system as a whole is seen as reducible to the functioning of its constituent parts/ actors (Dekker, Cilliers, & Hofmeyr, 2011). This means that our understanding of both safety and risk is derived from an understanding of the functioning of the healthcare system's components/ actors; risk emerges from malfunctioning/ erroneous components/ actors, and safety is founded on well-functioning components/ actors (Hollnagel et al., 2015). Patient safety management, which relies on this

reductionist view of safety, is reactive; it responds to something that has gone wrong (Hollnagel, 2013).

Wears and Sutcliffe (2019) note that this reductionist logic is appealing to the healthcare community because of its seemingly *scientific* nature (scientific is understood as reducing a problem to its constituent parts, and understanding their respective functioning or malfunctioning). The preceding section also makes clear that this is the view that has made its way into Swedish legislation. The approach assumes that a given system state (e.g. patient harm) can be traced back from the outcome and reconstructed, going all the way back to the root cause (Dekker et al., 2011). The purpose of patient safety investigations that follow this perspective is to increase the reliability (which is essentially the same as safety in a reductionist logic) of the system, by reducing the number of adverse events as far as possible. If events do happen, the aim is to restore the system to its statically functional norm by identifying causes, then improve functioning at the level of components/ actors and safety barriers (e.g. procedures or equipment) (Braithwaite, Wears, & Hollnagel, 2015; Hollnagel, 2013).

The main critique of the reductionistic approach is that it relies on judgmental hindsight (Dekker, 2014b)—knowing the outcome, it is easy to claim that someone should have acted differently—or a view that sees humans as the 'failed component' (Wears & Sutcliffe, 2019).

A holistic approach

The contrasting view to the reductionist approach is based on its inverse: the holistic principle states that the functioning of the whole *cannot* be reduced to the functioning of individual components/ actors. Instead, it seeks explanations for system behaviour in the interactions and relations between actors, and within and between system levels (e.g. hierarchies or levels of abstraction) (Dekker et al., 2011; Rasmussen & Lind, 1981; Wears & Sutcliffe, 2019; Woods et al., 2010). The approach emphasizes the interconnectedness and interdependence of the various components of a system, and the idea that the whole is greater than the sum of its parts. In recent years, the WHO has noted that patient safety has become a holistic concept, and emphasises that patient harm cannot be reduced by simply targeting front-end workers (WHO, 2021). The idea of holism can also be found in fields such as ecology, biology, and systems theory where it is used to understand the interactions and relationships between different parts of an ecosystem, organism or system. It can also be

applied to other fields such as sociology, psychology and philosophy to understand the interactions and relationships between individuals, groups and society as a whole.

In healthcare, there has been a struggle to formalize practices that can eliminate failure and create success (Cook et al., 2000). Studies of complexity reveal that failure is a consequence of a breakdown in the ability to adapt, while success is obtained when people can adapt and create safety (usually with multiple goals and trade-offs) (Rasmussen, 1997). Complexity theory sees patient safety strategies as an emergent property, in other words, the result of multifaceted interactions and relationships (Dekker et al., 2011). There is a clear relationship between complexity and 'emergence'; emergence, in this context, should be seen as a result of complex interactions between component parts (Hollnagel et al., 2006).

From the holistic perspective, there is no one 'best' method to describe complex system events (Dekker et al., 2011), and the viewpoint complements existing patient safety models. It expands patient safety work beyond the idea that rules and regulations are the gold standard to reduce patient harm. In complex systems such as healthcare, everyday performance variability enables adaptions to cope with uncertainty under various conditions (Hollnagel et al., 2015; Rasmussen, 1997). Performance variability provides flexibility within the system to match the conditions of work. From a holistic perspective, the functioning and performance of the healthcare system cannot be explained at the level of its constituent parts. Rather than counting cases of failure, holistic patient safety management studies interactions and adaptive capacities. It focuses on acceptable outcomes (when patient harm does not occur despite performance variability) and the ability to succeed under varying conditions (Hollnagel, 2014; WHO, 2021).

It is important to understand that both the reductionist and the holistic approach to patient safety co-exist, not just for legislative purposes, but because it is necessary to see patient safety from different perspectives. The holistic approach introduces a non-linear perspective; it learns from cases where things go right and creates ways to support this (Braithwaite et al., 2015; Hollnagel, 2014). In other words, there is a focus on learning from interactions and interpersonal relationships, and finding out what degree of freedom is necessary to cope with uncertainty. The approach that is adopted shapes the definition of patient safety.

The holistic perspective regards an outcome as due to complex causal (everyday) interactions, and not a single factor (Leveson, 2002). Arguments

about preventability become analytically irrelevant. Therefore, it provides an explanation for the build-up to a gradual reduction in safety, or a reduction in the requirement to maintain safety levels (Rasmussen, 1997). However, it is also problematical as it does not seek to reconstruct a chain of events, but rather to give multiple interpretations of interactions, relations, and adaptive capacities under variable conditions. Nevertheless, it can give a richer understanding of patient safety and expand ethical perspectives of accountability, as no single factor can be extracted (Dekker et al., 2011).

From a holistic perspective, discussions of preventability in the context of patient safety are based on linear (reductionistic) reasoning, which is irrelevant. This thesis focusses on how patient safety risk emerges from normal work, and how the healthcare sector can understand such risks.

Aim and research questions

The aim of this thesis is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach.

Study approach and rationale

At the time of undertaking the research for this thesis, I was working as a patient safety investigator within the Stockholm Centre for Dependency Disorder. I was a member of a team that investigated adverse events and patient harm within the clinic. At the time, I had an underlying feeling that the subjective judgements of experts were overly influential when determining whether harm was preventable or not. Furthermore, as my knowledge of patient safety grew, so did my interest in finding a more holistic approach when analysing adverse events. It seemed important to not just rely on one expert who claimed *this and that should not have happened*, but to understand the patterns of circumstances under which patient harm occurred.

In this thesis, I use safety theory and systems theory to reflect on the emergence of risk. I explore how the literature on patient safety, specifically as applied in psychiatric healthcare, understands risk, and to what extent contemporary safety science is used in analyses of psychiatric patient safety.

The object of study for my research is one of the biggest psychiatric clinics in Sweden, with over 20,000 patients and 350,000 patient visits each year. The clinic offers healthcare for patients with substance use disorder, which is a vulnerable patient group with excess mortality compared to the overall population (Babor et al., 2010; Walker, McGee, & Druss, 2015). As the emergence of risk is dynamic (Rasmussen, 1997), the number of healthcare visits to the clinic was considered a valuable source of data to investigate different views of safety performance. Previous research has investigated risk factors associated with multiple patient visits to psychiatry departments, such as patterns of premature mortality and readmission risk (Aagaard et al., 2016; Nyhlén et al., 2011; Sprah et al., 2017). Furthermore, studies of discharge from psychiatric healthcare have shown an increased risk of suicide and adverse events (Appleby et al., 1999; Mutschler et al., 2019). Overall, my experience created an opportunity to study the dynamics of risk using patient visits to the psychiatric clinic.

My approach was based on an investigation of retrospective data on patient visits. Different perspectives were used to analyse dynamic patterns of risk, with a focus on the meso level (the clinic). Data on both outpatient and emergency ward visits were used, together with a patient and system perspective on risk. The overall aim was addressed with two specific questions, which resulted in four research studies. The first research question centres on how risk and safety are constructed in the literature on psychiatric patient safety. The second focuses on the system perspective, and how emergent risk can be understood within a psychiatric clinic using patterns of patient visits. The latter question was addressed with three different perspectives: a) an analysis of emergent risk for the *clinic* using patterns of outpatient visits, b) an analysis of emergent risk for *patients* using patterns of emergency ward visits, and c) an analysis of emergent risk for the *ward* using patterns of patient visits.

The aim of this thesis is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach. This was addressed by the following two main research questions, and the second was divided into three sub-questions:

Research question 1
How does the current construct of patient safety in psychiatry reflect contemporary safety science?

The aim of this study was to explore patient safety strategies used in psychiatry, and determine how they construct the notion of preventable harm.

Research question 2

How can we understand emergent risk at the meso level, based on patient visit patterns to a psychiatric healthcare facility?

a) How can retrospective patterns of discharge be visualized to analyse everyday system variability, and adaptive capacities, over a longer time period?

The aim of this study was to analyse a psychiatric clinic's everyday 'normal' performance variability of discharge from inpatient to outpatient care.

b) How does the probability of dying vary with the number of visits to an emergency ward for substance use disorder as a function of age, gender, and diagnosis for substance use?

The aim was to identify patterns in death rates among patients with substance use disorder who visited an emergency ward for substance use, and to explore whether this knowledge can be used as input to identify patients at risk and increase patient safety.

c) What are the practical consequences for patient safety when conditions are stressed, and what constitutes stressed conditions in an emergency ward for substance use?

The aim was to explore emergent pressure in patient visits to an emergency ward for substance use disorder over time, and identify risk factors that impact patient safety.

Conceptual framework

In this chapter, I build a conceptual model of risk in psychiatric healthcare, which integrates the consequences that threaten to cause patient harm, based on emergent and dynamic uncertainties. The model adopts a holistic approach to patient safety, and analyses risk and safety as emergent properties of local-level adaptive strategies in dynamic and variable conditions (Rasmussen, 1983). This approach sees humans as capable of adapting to their locally-perceived environments, and adjusting their actions within their available degrees of freedom (Dekker, 2014b; Hollnagel et al., 2006; Rasmussen, 1983). The idea is that support systems can be designed to help people to understand the conditions they operate under (i.e. emergent patterns of risk), and contribute to people's adaptive capacities (Rasmussen, 1997). It is therefore essential to understand risk and safety from a holistic perspective.

Risk

The term *risk*, in the context of patient safety, expresses the potential to cause harm, or an unwanted outcome (Wears & Sutcliffe, 2019). It is a probabilistic estimate which can be debated, and is, ultimately, a social construct (Hansson, 2004; Wears & Sutcliffe, 2019). Hence, it is perceived as a static product of the reliability of various protective systems (barriers) in relation to the severity of possible consequences – although it should be noted that the perception of risk is based on subjective values and hierarchy. In this thesis, the term is used in relation to patient harm, in other words, the (serious and less serious) consequences of preventable harm for a patient, such as prolonged hospital stays, infections, or death. Risk is not understood as a static property, but instead "refers to uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value" (Aven & Renn, 2009, p.1). It is therefore not seen as an objective property of a system, instead, it depends on what is considered valuable (Tehler, 2023). In the

present context, it is the prevention of adverse effects for patients associated with healthcare (WHO, 2023).

Society's perception of risk has shifted; from a time when accidents and risk were seen as random or divine acts, to an engineering problem at the end of the 19th century (Green, 2020). The idea of risk as a static property is partially due to patient safety theories—safety barriers are considered reliable and can be measured, meaning that risk can be calculated (Reason, 1990). Risk analysis in healthcare is frequently built upon this view, and risk can be estimated using an impact-probability table. Such risk assessments are used to identify conditions that may jeopardise a system in the future (Hollnagel et al., 2006). But increasing risk can be concealed through gradual acceptance, which is culturally taken for granted (Dekker, 2011; Pidgeon & O'Leary, 2000; Vaughan, 2016), and risk perceptions change over longer time periods. In a linear chain of events, we can predict the outcome, but in complex systems, there are unfamiliar, unexpected, invisible or noncomprehensive sequences. Perrow (2011) argues that the cause of accidents in complex and tightly coupled organizations does not lie in their design or construction. It lies in unexpected reactions to small, usually trivial events that have unforeseen consequences. Although healthcare could be considered a loosely coupled organization (Tamuz & Harrison, 2006), it does not matter how much we try, it is in the nature of complex organizations to be unable to get a grip on all possible outcomes (Perrow, 2011). Risk becomes an emergent result of local interactions, and the complex interplay of different factors. For example, the diversity of patients and their changing health conditions, the advancement of technology, and changes in policies can impact the way healthcare is delivered, adding to the complexity of the system.

According to contemporary safety science, uncertainty in complex systems does not necessarily contribute to failure; "everyday performance variability provides the adaptations that are needed to respond to varying conditions, and hence is the reason why things go right" (Hollnagel et al., 2015, p. 4). Within the patient safety literature, performance variability has been perceived both as a source of risk (Reason, 1990), and a necessity for maintaining safety (Hollnagel et al., 2015). The research reported in this thesis illustrates an approach that embraces performance variability, within the complex system that is healthcare. Hospital emergency departments are often used as an example to study emergent risk within the healthcare system (Stephens et al., 2015). These environments are an opportunity to monitor system pressure, how the healthcare system is matched to demand, and how it is able to accommodate

changing demands (Hollnagel et al., 2006). It can also seek to develop the ability to anticipate problems (Woods, 2005) and to detect the emergence of risk. Patient safety is therefore not only about reducing incidents, but also managing risk over time, and adapting measures to the context.

Risk in psychiatric healthcare

In psychiatric healthcare, violence, non-fatal self-harm, and suicide are the principal concerns in the context of patient safety management. Predicting violence is challenging; it is often centred around de-escalating skills (Solorzano Martinez, 2016) and reducing the availability of unsafe items, with limited results (Bowers et al., 2002). Overcrowding, a lack of privacy and front-end workers' experience have also been identified as factors that can impact the risk of violence on a meso level (Davis, 1991; Sloan, 2001).

Preventing suicide is also challenging, as it is not a consequence of a single factor or due to modifiable causes that could reduce risk over time (Fröding, 2022). However, it is one of the most common reasons for inpatient care (Wasserman et al., 2012) and suicide risk prevention is a fundamental purpose of psychiatric healthcare (Brodsky, Spruch-Feiner, & Stanley, 2018). This creates challenges for patient safety management, as healthcare is subject to technical development, challenging economic conditions and ever-changing regulatory processes. Reducing risk and improving patient safety, in this context, requires a system perspective, together with the development of better incident investigation techniques (Woloshynowych et al., 2005).

Given that psychiatric healthcare is inherently unpredictable at the system level, and, at the same time, is affected by an external reality (which is also changing), there will always be risks and accidents that cannot be foreseen (Rasmussen, 1997). The ability to adapt to unpredictability (uncertainty) and emerging risk is sometimes described as being resilient (Bergström, Van Winsen, & Henriqson, 2015). Research has found that resilient organizations that can adapt to increased pressure, and respond to various conditions, could buffer a risky work environment (Cook & Rasmussen, 2005). Psychiatric healthcare is no exception. In somatic healthcare, there is a perception that injuries from medical care could be considered as an 'acceptable' risk, due to the desired benefits of the medical intervention (Wears & Sutcliffe, 2019). While this perception of patient safety risk has been criticised, healthcare does need a buffer system that supports the management of unpredictable events

(Cook & Rasmussen, 2005), together with systems that help in visualizing and interpreting dynamic patterns of emergent risk, available degrees of freedom, and adaptive capacities. Monitoring sources of variability, such as patient visits over time, can create a visualization of emergent patterns of risk.

This thesis will operationalize emergent risk in psychiatric healthcare in terms of revisits (Papers II and III), and stressed conditions (Paper IV) by investigating patterns of patient visits, and how risk is manifested.

Safety

Safety can be defined as an emergent property of adaptive capacities under performance variability (Braithwaite et al., 2015). To create safety, you need enough control mechanisms to match each of a system's variations (Ashby, 1964). However, in the context of everchanging, complex systems, Rasmussen (1997) points out that this could lead to conflicting operational goals. Consequently, patient safety should adopt a cross-disciplinary approach, as a diverse set of skills and different backgrounds will help to broaden interpretations and find possible solutions (Wears & Sutcliffe, 2019). Increasing safety in healthcare requires deep insights on multiple levels, which, in turn, requires knowledge from different academic disciplines (Rasmussen 1997). Vincent and Amalberti (2016) suggest that a timescale perspective, complemented by a reflection on outcomes when things are going well, and the ability to detect patterns of gradually increasing risk, are prerequisites for safety. The analysis could adopt either the patient's or a healthcare perspective, and the focus could shift to controlling the effects of errors rather than eliminating them (Vincent & Amalberti, 2016). The fact that healthcare has adopted a zero-tolerance approach to patient harm, combined with increased standardization and proceduralization, has tended to create a safety bureaucracy (Dekker, 2014a; Smith, 2018; Wears & Sutcliffe, 2019). Patient safety could go beyond this zero harm vision, and instead aim to be as safe as possible, based on stated goals and tolerance for risk (Vincent & Amalberti, 2016). Although the bureaucratization of safety has negative connotations, since it can create constraints and reduce safety initiatives (Dekker, 2014a), it also creates an opportunity for the analysis of the large amount of data that are recorded.

Safety in psychiatric healthcare

In psychiatric healthcare, patient safety predominantly revolves around suicide prevention, minimizing self-harm, and securing safe drug treatment and discharge planning (Marcus, Hermann, & Cullen, 2021). The term 'safety', in the psychiatric context, is sometimes used as a synonym for security, as protection from violence is a great concern. Policies often include focus on ward security, notably in the form of locked doors and the reduction of unsafe items (Abela-Dimech, Johnston, & Strudwick, 2017; Solorzano Martinez, 2016), although it should be noted that what constitutes an unsafe item is debatable, and is influenced by the context (Bowers et al., 2002). At the present time, there is no one 'best' method for increasing patient safety, as each technique has trade-offs (Hagley, Mills, Watts, & Wu, 2019). Clinical standards set by experts provide a foundation for safety, but even this introduces risk, as new problems will occur as medicine advances (Braithwaite, Runciman, & Merry, 2009).

Many authors recommend a root cause approach to risk management in psychiatric healthcare. This is thought to be the best way to calculate risk and prevent an undesirable outcome, thereby obtaining safety (Bertolote, de Mello-Santos, & Botega, 2010; Carroll, 2008; Ellis et al., 2009; Lin et al., 2014; Scott, 2016; Yeager et al., 2005). From this perspective, aspects such as professional skills, adequate training, and education become important conditions for safety. Safety is seen as a static term, something that psychiatric healthcare develops and *has*. However, safety can also be improved through a collaborative approach with patients, based on shared decision-making, and a structured healthcare plan to reduce self-harm or hospitalizations (Barnicot et al., 2017; Steffen, Kösters, Becker, & Puschner, 2009; Strand & Von Hausswolff-Juhlin, 2015).

Safety can be regulated on several levels: policies, finances, guidelines and routines all aim to motivate, educate, and guide employees to increase safety (Rasmussen, 1997). This reflects a classical and reductionist perspective, which focuses on limiting degrees of freedom (i.e. limiting variability). The same principle has been proposed in the domain of psychiatry (Brickell & McLean, 2011; Marcus et al., 2021). Although this approach could work in a stable environment, where all levels of a process can be foreseen, it is limited by the laws of complexity in situations where performance is an emergent property (Dekker et al., 2011). In contrast, a holistic perspective sees performance variability as something that requires degrees of freedom in order

to create safety. Safety is a property that depends on both the system, and individual and collective performance (Braithwaite et al., 2009).

The ability to maintain a continuous awareness of the dynamics of risk, and develop the capacities, resources, and strategies to adapt to them, is therefore overlooked. Psychiatric patient safety tends to rely on the view that safety is something that the system *has*, instead of discussing it as a dynamic process. Enhancing patient safety will require an effort to understand how different sources of risk impact everyday work (Cook, Woods, & Miller, 1998).

Risk as an emergent property

The holistic principle, which states that the behaviour of the system cannot be explained by the behaviour of its constituent components (Dekker et al., 2011), summarises the principle of emergence. More concretely, holism implies that the behaviour of the whole 'emerges' from everyday 'normal' interactions and relations between system actors, resources, and components. An approach that is based on emerging patient safety emphasizes the conditions under which front-end workers succeed (WHO, 2021). The principle of emergence implies a relationship between different levels of the system, levels of aggregation, or scales. Both risk and safety can be argued to be system properties that emerge from interactions at lower system levels (Hollnagel, 2004; Hollnagel et al., 2006; Leveson, 2002).

In this thesis, which focuses on psychiatric healthcare, emergent risks are studied as meso-level patterns of uncertainties about the consequences (with respect to patient harm) of micro-level activities. The principle of emergence primarily relates to the meso-level risks that emerge from the relationship between micro-level interactions and relations (adaptive capacities and performance variability), over time and space. Emergence implies a mismatch between levels of aggregation of a system (in this thesis, between micro and meso): patterns 'emerge' at higher system levels from interactions and relations at lower system levels. The emergence of risk is the common denominator in Paper II, Paper III and Paper IV. These papers use three different perspectives: emerging patterns of micro-level adaptation (Paper II), risk as consequences for the patient (Paper III), and risk as consequences for the ward (and ultimately the patient) (Paper IV).

The dynamics of risk and safety

"Organizational resilience is an emerging property of complex systems"

(Pariès, 2006, p.43)

Healthcare providers have an obligation to identify and mitigate patient safety risk through a range of strategies, which include implementing best practices and protocols, ensuring effective communication, and improving processes and working conditions (Socialstyrelsen, 2017; Vincent & Amalberti, 2016; WHO, 2021). This constitutes the foundation for patient safety. However, as concepts of risk and safety can lead to a discussion of how to reduce failure, we need to keep in mind that psychiatric healthcare creates positive outcomes every day.

In this thesis, the notion of 'dynamics' implies that emergent risk changes over time (Dekker, 2011; Rasmussen, 1997). As humans, our perception of our environment is based on the context in which it is perceived (Rasmussen, 1983). This introduces a degree of variability in performance, where some will fail, and some will succeed. The safety science literature suggests that we need to acknowledge this dynamic, and recognise that all performance springs from the same source, and the same behaviour, whether it fails or succeeds (Braithwaite et al., 2015; Cook et al., 1998). From a holistic perspective, the relationship between local-level behaviour and system-level failure is not linear (Dekker et al., 2011). Safety in complex environments such as healthcare comes from understanding performance variability and pressure (Braithwaite et al., 2015; Patterson, Cook & Woods, 2006). The naturally-occurring changes in complex systems can, in themselves, benefit patient safety (Braithwaite et al., 2009). In this context, healthcare workers can acquire a degree of flexibility that supports their adaptive capacities, and enables them to cope with uncertainty. In practical terms, they can adjust the situation so that patients with complicated, uncertain conditions do not pose a threat to other patients. The ability to make these adjustments creates safety in an uncertain environment (Hollnagel et al., 2015).

Performance variability can be essential for safe emergency care, as it enables front-end workers to adapt their behaviour based on their experience and the situation (Sujan et al., 2014; Wears, Hollnagel, & Braithwaite, 2017). Nevertheless, several approaches have been proposed to improve patient safety and emergency department performance (Austin et al., 2020), which do not acknowledge that performance variability is a requirement (Rasmussen, 1983).

Supportive systems are needed that can guide patient safety managers in how to cope with uncertainty.

Resilience Engineering

This thesis focuses on how risk and safety emerge from adaptive capacities and performance variability, and this approach positions it in the field of Resilience Engineering. Resilience Engineering was established when a group of distinguished researchers in safety science met, in Söderköping, Sweden in 2004, to discuss the topic. A challenge to the notion that the tabulation of errors and countermeasures was the best way to reduce unwanted incidents, Resilience Engineering was described as "a paradigm for safety management that focuses on how to help people cope with complexity under pressure to achieve success" (Hollnagel & Woods, 2006, p.6). The approach argues that safety is a core value; it is not a static property, but instead something that changes, and that can conflict with other values. Hence, managers could focus on proactive anticipation, and see safety from the viewpoint of unwanted events that did not happen (Hollnagel et al., 2006). The idea of Resilience Engineering can be traced back to Rasmussen's work in the 1980s, where he argued that it was impossible to have an overview of all performance variation in complex organizations, and that errors were only judged with respect to a norm, in an 'unkind' environment (Bergström & Dekker, 2019; Rasmussen, 1982).

Resilience Engineering has changed the focus of safety management initiatives: rather than being driven by hindsight, the aim is to learn from past adaptions to prevent accidents in the future (Hollnagel et al., 2006; Woods, 2015). As it sees both failure and success as originating from the same adaptations and performance variability, safety is achieved by controlling performance variability, rather than constraining it (Hollnagel, 2008).

Resilient Healthcare is a branch of Resilience Engineering. It is a way to address the complex safety challenges of healthcare. Members of the community focus their research and management efforts on making risk more apparent, and enhancing front-end workers' abilities to respond effectively to emerging risks (Hollnagel, 2014). Resilience is viewed as a capacity to be designed/ engineered (Dekker, 2016), and healthcare resilience is the ability of the system to adjust its functioning according to current conditions (Wears, Hollnagel, & Braithwaite, 2015; Wears et al., 2017).

Methodology

Case study

This thesis should be considered as a case study of the emergence of risk and resilience (in terms of sources of adaptive capacities and performance variability) in the Stockholm Centre for Dependency Disorder, and the emergency ward for substance use disorder. The ward offers and initiates treatment to people over the age of 18 with addiction to alcohol, narcotics, other drugs and/ or pharmaceuticals in Stockholm County, Sweden. It is open 24/7, has around 20,000 patient visits each year, and offers both voluntary and compulsory care under Swedish healthcare legislation (*the Treatment of Addicted Persons Act, the Compulsory Psychiatric Care Act*). The emergency ward for substance use disorder focuses on carrying out healthcare assessments, treating risky withdrawal conditions, and monitoring the recovery of patients. All patients are medically assessed on arrival, and receive a diagnosis and decision regarding further treatment. The emergency ward is one of the psychiatric clinic's 65 wards. The clinic offers both inpatient and outpatient treatment for patients with substance use disorder, and it is the biggest psychiatric clinic in Stockholm County.

Emergency wards (or departments) are considered a suitable environment for analyses of adaptive capacities and resilient healthcare (Nugus et al., 2011; R. L. Wears & Woods, 2007), and patterns of patient movements within the healthcare system provided the foundations for developing the method and design of this thesis.

In a case study, both qualitative and quantitative data can be collected to build a comprehensive understanding (Fetters, Curry, & Creswell, 2013; Yin, 1999). Patient visits were used as quantitative data to explore changing conditions over time. As case studies are a suitable way to study complexity and how systems change over time (Sibbald et al., 2021; Yin, 1999), the research reported in this thesis adopted three different perspectives when exploring dynamic risk landscapes within the emergency ward. Specifically, risk and

patient safety were analysed from the angle of the clinic (Paper II), the patient (Paper III) and the ward (Paper IV).

An insider view, reflection and problem understanding

As both an insider and a researcher (a specialized psychiatric nurse working as a clinical investigator on patient safety), I had an insight into how to conceptualize the research and define the problem. Data collection was driven by specific acknowledged and unacknowledged patient safety issues within the studied clinic. As I had worked as a patient safety investigator for several years, reading thousands of incident reports, and giving hundreds of lectures and discussions on patient safety, I had developed an understanding of common problems within the clinic. My insider status enabled me to approach clinical experts and discuss issues prior to data sampling, which helped me to phrase my research questions. However, data collection and interpretation can, arguably, be influenced by an insider's perspective (Lapadat, 2017) and this issue was addressed by using empirical references to improve idea generation. This approach supported an exploration of the practical usefulness of different patient safety models (Alvesson & Sandberg, 2022).

Discussing problems as an insider helped me get a deeper understanding of the practical implications of patient safety management strategies. Notably, I had seen the front-end effects (for the clinical nurse or doctor) of traditional measures used to improve patient safety. This insight influenced my research, as I have witnessed several attempts to improve patient safety that ended in increased bureaucracy and regulation. Therefore, my starting point was to explore if patient safety could be addressed on a system level, with implications for decision-makers rather than clinical front-end workers.

Of course, the insider perspective also had some disadvantages. As I combined my research with my clinical work, I was sometimes mentally in two places at once. Identified patient safety problems could not be overlooked, and could, in a sense, be said to increase my workload. This hurdle was addressed with the help of my supervisor, through valuable discussions on the insider-researcher perspective.

Ethical considerations

Research that involves people or sensitive personal data must be approved by The Swedish Ethical Review Authority. Paper I was a scoping review, with the purpose to explore how patient safety strategies have been used in psychiatric healthcare, and how they target the reduction of preventable harm. The literature search provided an overview of research areas and identified gaps within the studied field. No ethical considerations were identified in this study.

Patients with substance use disorder often seek treatment from psychiatric and social services, resulting in a high frequency of healthcare interactions. Increased understanding of how healthcare providers organize healthcare is beneficial, as it enables the healthcare system to tailor resources according to the patient's needs. Paper II-IV aim to supplement the understanding of how patients interact with healthcare providers, with the goal of improving resource allocation, healthcare delivery and patient safety. Paper II-IV was approved to use registry data for the studies by The Swedish Ethical Review Authority (ref: 2019–04026 and Amendment 2021–02393). The Paper II-IV used retrospective de-identified data and no informed consent from the patients was necessary.

Data for Paper IV was also collected from a focus group consisting of respondents who worked at the clinic where the study was conducted. Participation was voluntary, and staff were allowed to participate during working hours. All respondents were bound by a duty of confidentiality, and there was no indication that any sensitive information had been disclosed. The participation by the focus group was approved by the Stockholm Centre for Dependency Disorders in accordance with established ethical guidelines.

Study designs

A scoping review of patient safety within psychiatric healthcare (Paper I)

Paper I addresses research question 1 through a scoping review. The review systematically explored how patient safety strategies have been used in psychiatric healthcare, and how they seem to contribute to the reduction of preventable harm. The aim of this study was to explore patient safety strategies

used in psychiatry, and determine how they construct the notion of preventable harm. The reason for using a scoping review was to explore the literature and identify gaps within the field of interest, and it was conducted using Arksey and O'Malley's methodological framework (Arksey & O'Malley, 2005). The Scopus, MEDLINE, PsycInfo, and CINAHL databases were used, and the search was narrowed to articles published in the English language after the year 2000. After title and abstract screening, 171 documents were included in the full review, along with seven additional articles from the grey literature. The scoping study reported in Paper I reviewed 92 articles (Figure 1) describing 64 different patient safety strategies. Keywords related to patient safety strategies and possible outcomes were coded from the results, discussion or conclusion of these articles. Coding was based on keywords and themes, and, for each study, outcomes were linked to a discussed strategy to increase patient safety. The result was presented in a table that listed focus areas as a function of strategy and potential outcome.
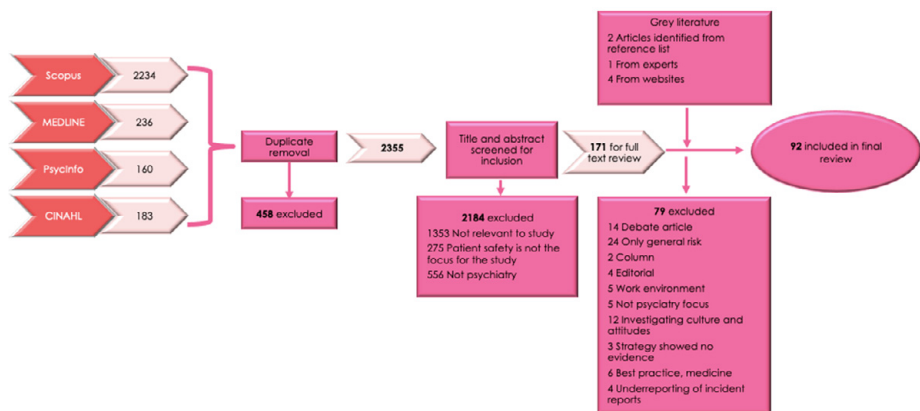
Figure 1: Illustration of the literature review reported in Paper I (Svensson, 2021).

A retrospective longitudinal case study of patterns of outpatient visits (Paper II)

Paper II addresses research question 2a. It focuses on understanding emergent risk (patient revisits), in a context where sources of adaptability and variability (dynamics) are produced during the process. Emergent risk was operationalized through a case study of visits to the psychiatric clinic. The aim of this study was to analyse a psychiatric clinic's everyday 'normal'

performance variability of discharge from inpatient to outpatient care. The study was built around Rasmussen's theory of dynamic risk migration (Rasmussen, 1997), which introduces both system pressure over time and performance variability. The model, which illustrates how systems adapt their operations to meet multiple and sometimes conflicting operational goals (Figure 2), was modified from Cook and Rasmussen (Cook & Rasmussen, 2005) and inspired the design of the study.
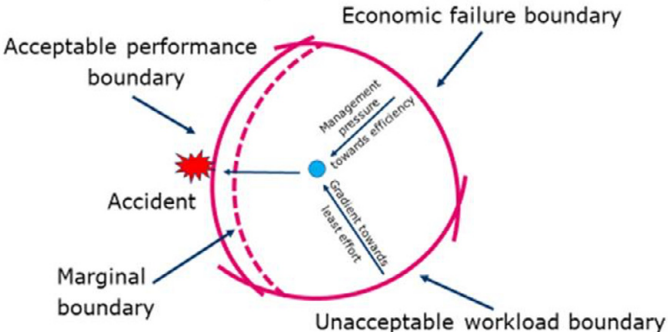
Figure 2: Illustration of the theoretical concept upon which Paper II was developed (Svensson & Bergström, 2020). Modified from Cook R, & Rasmussen *J. Qual Saf Health Care* 2005;14 [2]:130–134.

The study investigated 70,797 anonymized outpatient visits between 2010 and 2018. All patients included had previously been treated as an inpatient by Stockholm Centre for Dependency Disorders. The investigation was designed as a retrospective longitudinal study with strategic selection, meaning that outpatient visits of selected patients were compared over time. Included patients had all been discharged from inpatient care, and continued to receive outpatient care from the clinic. Only those who were resident in Stockholm were included (Figure 3).

Figure 3: Inclusion and exclusion process (Svensson & Bergström, 2020).

The analysis included a time-lapse visualization of the discharge process – from inpatient care to a follow-up visit as an outpatient. A location was added to each outpatient unit, and the visualization created accurately-located stacked columns on a map. This visualization showcased the fluctuation in patient visits to outpatient units, and how this had changed over the studie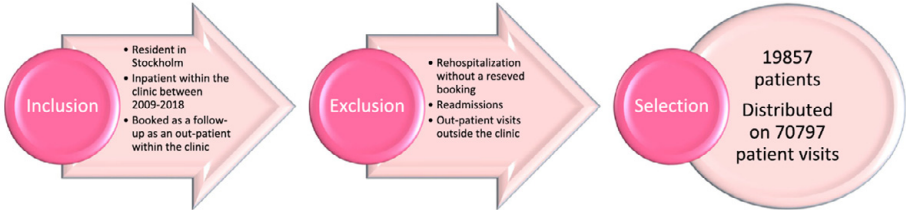d nine years. Patient movement trends were highlighted for each of the 81outpatient units included in the study. The visualization provided insights into certain characteristics of outpatient visits, and led to a subsequent investigation of cancelled visits, and patients who decided to visit the emergency ward instead. Paper II left many unanswered questions regarding how the emergence of system risk impacted patients, and whether patterns of risk could be identified at the patient level.

A death rate and risk ratio analysis of patients visiting an emergency ward for substance use disorder (Paper III)

Paper III addresses research question 2b. The case study of patterns of outpatient visits (Paper II) suggested that the healthcare system supports both temporal and functional variability, which is used by patients who adapt to their changing condition. The latter study raised new questions regarding whether patient risk emerges, and, if so, how it could manifest.

Paper III seeks to address these questions by analysing the relation between the pattern of patient visits to the acute substance use disorder ward and the risk of patient mortality, based on the patient's diagnosis and the number of visits. The aim was to identify patterns in death rates among patients with substance use disorder who visited an emergency ward for substance use, and to explore whether this knowledge can be used as input to identify patients at risk and increase patient safety. Data were extracted from medical records for the period 2010–2020, and information about gender, age, substance use diagnosis, and mortality were examined. All included patients had received a diagnosis for substance use disorder by clinical doctors at their time of presentation at the emergency ward (Table 1).

The annual death rate in the study group was compared to the base mortality rate in Stockholm County for the same year, and a risk ratio was calculated to quantify the difference in mortality risk. The analysis focused on one specific substance use diagnosis for each visit, or a combination of specific diagnoses, even though patients could have multiple diagnoses during each visit. The

ICD-10 psychiatric taxonomy was used to distinguish between substance use diagnoses, and the study included all mental and behavioural disorders due to psychoactive substance use (F10–F19). All participants were allocated a unique identification number, but those who did not have a Swedish identity number were excluded due to technical issues related to tracking. This resulted in 5.9% of total visits to the emergency ward being excluded. Nonoverlapping confidence intervals (95%) were used, divided by binary categorical variables to identify a statistically significant difference in death rates between various groups (e.g. men and women, or opioids and sedative hypnotics). The Kruskal–Wallis rank sum test was used to check for ordinal differences in death rates, and a risk ratio was used to quantify differences in mortality risk for each binary categorical variable. By identifying correlations between the number of visits for each diagnosis and the corresponding death rate, the analysis showed patterns of risk for premature death.

Table 1 Characteristics of patients included in Paper III.

Total number of patients 2010–2020	37,959 patients
Total number of visits 2010–2020	157,200
Proportion of female and male	31.22% and 68.78%
Year of birth (mean)	1921–2004 (1973)
Patients with F10, alcohol diagnosis (%)	27959 (73.66%)
Patients with F11, opioids diagnosis (%)	2903 (7.65%)
Patients with F12, cannabinoids diagnosis (%)	1957 (5.16%)
Patients with F13, sedatives or hypnotics diagnosis (%)	2031 (5.35%)
Patients with F14, cocaine diagnosis (%)	550 (1.45%)
Patients with F15, other stimulants, incl caffeine diagnosis (%)	2582 (6.80%)
Patients with F16, hallucinogens diagnosis (%)	89 (0.235%)
Patients with F17, tobacco diagnosis (%)	3 (0.0079%)
Patients with F18, volatile solvents diagnosis (%)	15 (0.0395%)
Patients with F19, multiple drug use and other diagnosis (%)	8964 (23.62%)
Number of types of diagnoses (mean)	1–7 (1.24)
Visits per patient (mean)	1–449 (4.14)
Overall death rate during the study period	0.1404

Although Paper III identified the emergence of risk at the patient level, it raised questions about how risk manifests in the studied emergency ward.

A mixed methods case study of the healthcare facility's capacity of manoeuvre (Paper IV)

Paper IV addresses research question 2c. It analyses patterns of patient visits operationalized as dynamically changing organizational pressure. The aim was to explore emergent pressure in patient visits to an emergency ward for substance use disorder over time, and identify risk factors that impact patient safety. The concept of 'capacity of manoeuvre' is used to refer to the degree of freedom or adaptive behaviour that the system has when faced with challenging events (Stephens et al., 2015). A mixed methods, sequential explanatory design was used (Ivankova, Creswell, & Stick, 2006), which consisted of a quantitative phase, followed by a qualitative phase of data collection.

The long-term quantitative analysis of patient visits provided a foundation for a focus group discussion of the statistical results. The study used triangulation (Yin, 2002) in a four-phase design. First, clinical experts were probed in order to develop useful questions for future statistical analysis. In phase two, data regarding patient visits to the studied ward were collected from medical records for the period 2010–2020. Data included the number of visits (Table 2), their diagnosis, and their gender. Phase three consisted of a statistical analysis based on an iterative coding structure, which included a trend analysis and a moving average. Finally, in the last phase, a focus group consisting of clinical experts working at the facility discussed the outcomes of the statistical analysis in relation to clinical practice.

Table 2 Annual number of patients visits analysed in Paper IV.

Year	Number of visits
2010	13268
2011	13695
2012	14042
2013	14147
2014	14428
2015	15446
2016	15832
2017	16180
2018	18099
2019	19167
2020	19486

Results

Paper I

Patient Safety Strategies in Psychiatry and How They Construct the Notion of Preventable Harm: A Scoping Review

Paper I uses a scoping study to systematically explore how patient safety strategies have been used in psychiatry, and how different measures reduce preventable harm. The paper presents results with respect to seven focus areas identified in the literature as able to increase patient safety within psychiatric care. The primary strategies aim to reduce suicide, self-harm, violence and falls. However, the literature review found that there is a wide diversity of measures, and no unified strategy. Implementation of the suggested measures often relied on reducing variability, while at the same time increasing standardization (Svensson, 2021).

Patient safety strategies were categorized into seven themes: "risk management", "healthcare practitioners", "observation", "patient involvement", "computerized methods", "admission and discharge" and "security". In the psychiatric literature, these strategies were mainly developed from a reductionistic cause-effect perspective, and relied on front-end workers' performance, competence and compliance (if implemented). Overall, the key messages were that front-end workers' skills and education were seen as vital, and that healthcare should be well-planned. Arguments regarding how patient safety could be strengthened centred on the notion of preventability. The review highlighted that a variety of different improvements could be justified in response to the same type of adverse event, through a focus on different aspects of patient harm. Moreover, theories of performance variability and risk as a dynamic property were not taken into consideration as a way to increase patient safety.

Specifically, Paper I identified the following seven key messages supported in the psychiatric literature to improve patient safety:

- Standardised risk assessment protocols may be less vital than individual adjustments and the ability of front-end workers to engage in a therapeutic dialogue.
- Safety strategies could be used to support front-end workers by developing standard guidelines and making recommendations. A sufficient number of well-trained, educated front-end workers provide the foundation for patient safety.
- Continuous observation requires planning if it is to become more subtle and better-understood by both patients and front-end workers.
- Mutual agreements between patients and front-end workers could reduce adverse events and have positive benefits.
- Electronic notifications integrated into the medical system could help reduce adverse drug events.
- Rehospitalization could be reduced by using patient-controlled admissions and discharge planning, with follow-up visits to outpatient units.
- Reducing violence mainly relies on the de-escalation skills of front-end workers. The outcome of policies based on restrictive measures that ban certain items cannot be established as there is wide variation in the literature.

Overall, Paper I highlighted that a variety of patient safety strategies are promoted in the psychiatric literature to reduce unwanted outcomes. The reviewed corpus did not include a discussion of performance variability or the dynamic migration of risk to reduce patient harm. These findings triggered questions regarding what such an analysis would look like in the context of a psychiatric clinic.

Paper II

Visualizing healthcare system variability and resilience: a longitudinal study of patient movements following discharge from a Swedish psychiatric clinic

Paper II reports on how we can use data linked to outpatient visit patterns, following discharge from a psychiatric clinic, to improve resource prioritization. The study found that 42% of scheduled follow-up visits to outpatient psychiatric facilities were not completed as expected. Instead, patients either cancelled their visit or returned to the emergency ward. The results of the study were visualized using geographical locations, which made it possible to distinguish patterns of patient movement (Figure 4).
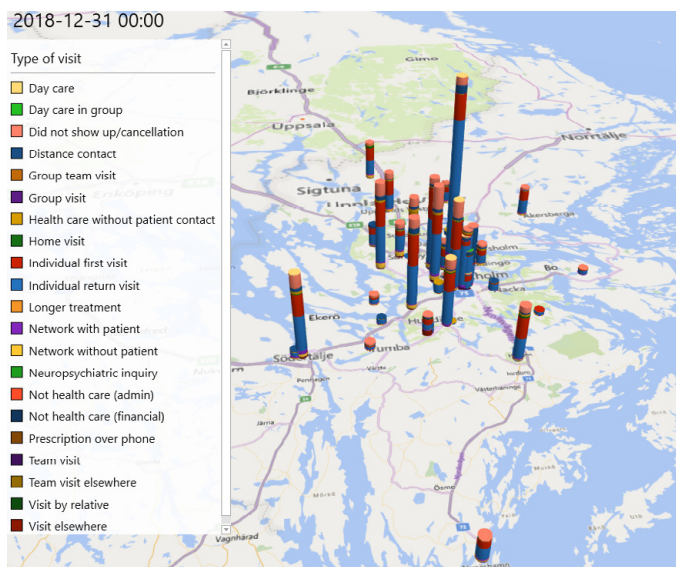
Figure 4: Outpatient visits over a 9-year period. Visits to the clinic's emergency ward have been excluded (Svensson & Bergström, 2020).

The findings from this study showed that the number of patients who did not show up for their scheduled outpatient visit, or who visited the emergency ward instead, increased over the nine studied years. Moreover, the number of cancelled outpatient visits increased each year; at the same time, the mean number of days until the next emergency ward visit decreased (Table 3). The

patient usually received an appointment for an outpatient visit the following day.

This study focuses on discharge from inpatient to outpatient care, and analyses risk as an emergent property on a system level. The visualization of 'normal' patient dynamics highlights several trends. The study therefore introduces a new approach to analysing organizational adaptive capacities. The pattern of patient visits illustrated variability in planned healthcare, along with cancelled visits and the places where patients seek healthcare. The findings suggest that the psychiatric healthcare system creates a space with both temporal and functional variability. This visualization of visiting patterns can help strengthen patient safety by prioritizing resources. By analysing patient interactions, stakeholders can estimate current and future stressors, and identify potential system migration towards risk.

Table 3: Five variables that emerged from the visualization as of particular interest during the transition from inpatient to outpatient care (Svensson & Bergström, 2020).

Variables	Year								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of appointments for outpatient visits for the clinic's inpatients	7680	8340	8066	7844	7666	8020	8034	7738	7409
Days between inpatient care and the outpatient appointment (median)	9	6	5	6	5	5	7	7	5
Did not show up/ late cancellation of the outpatient appointment	119	177	259	327	366	436	509	484	530
Median number of days until the next emergency ward visit	27	25	30	31	26	20	18	17	10
Visits to the emergency ward instead of the outpatient appointment (number)	2988	3331	2945	3086	3126	3509	3769	3692	3389
Visits to the emergency ward instead of the outpatient appointment (%)	39.91%	39.94%	36.51%	39.34%	40.78%	43.75%	46.91%	47.71%	45.74%

Paper II highlights a discrepancy between expected and actual patient visits to the clinic. However, the study does not answer questions regarding the potential consequences for patients who return to the emergency ward. Paper III is an attempt to analyse these consequences in detail.

The results of Paper II contribute to our understanding of how micro-level interactions have consequences at the meso level, and how to study everyday performance variability and adaptive capacities that result in emerging patterns of risk (Figure 5).
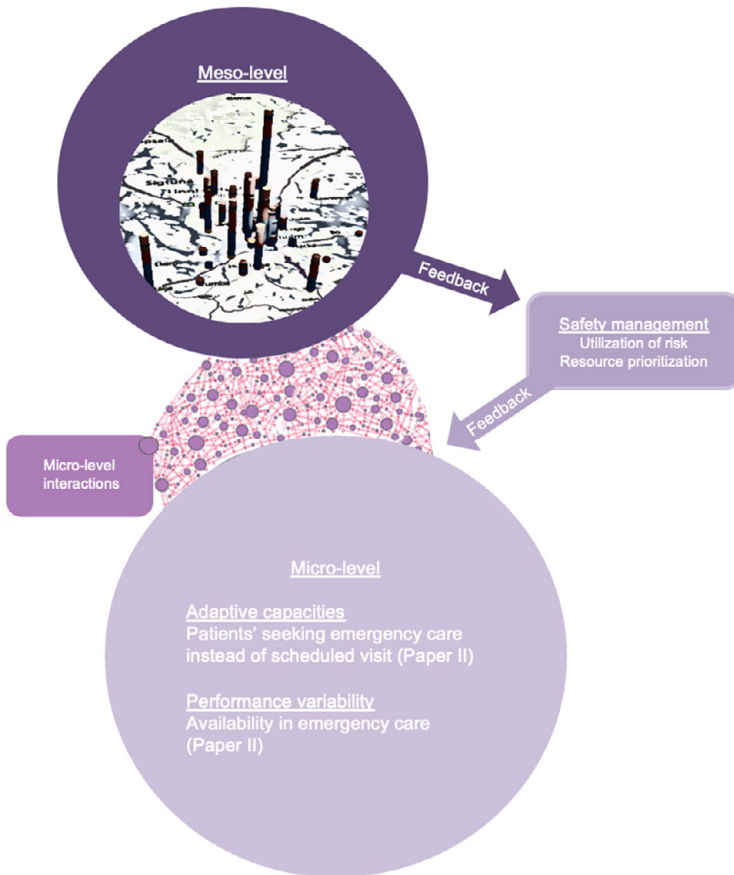
Figure 5: Conceptual schema of the research reported in Paper II.

Paper III

Patterns of mortality risk among patients with substance use disorder: an opportunity for proactive patient safety?

Paper III analyses how visiting patterns to an acute psychiatric ward for substance use disorder and addiction can indicate a risk of increased mortality, based on the patient's diagnosis and the number of visits. Data for the period 2010–2020 related to visits to an emergency ward for substance use disorder were sampled, and included information about gender, age, substance use

diagnosis, and time of death. The study revealed that male patients had a 1.41–1.59 higher mortality risk than female patients, and that patients with a disorder due to opioid use, or sedative hypnotics use had the highest death rates. A patient who visited the emergency ward for opioid use, then later visited the same ward to treat sedative hypnotics use also had a higher mortality risk. The combination of these drugs was associated with the highest death rate. Similarly, the number of times the patient had visited the ward impacted their mortality risk.
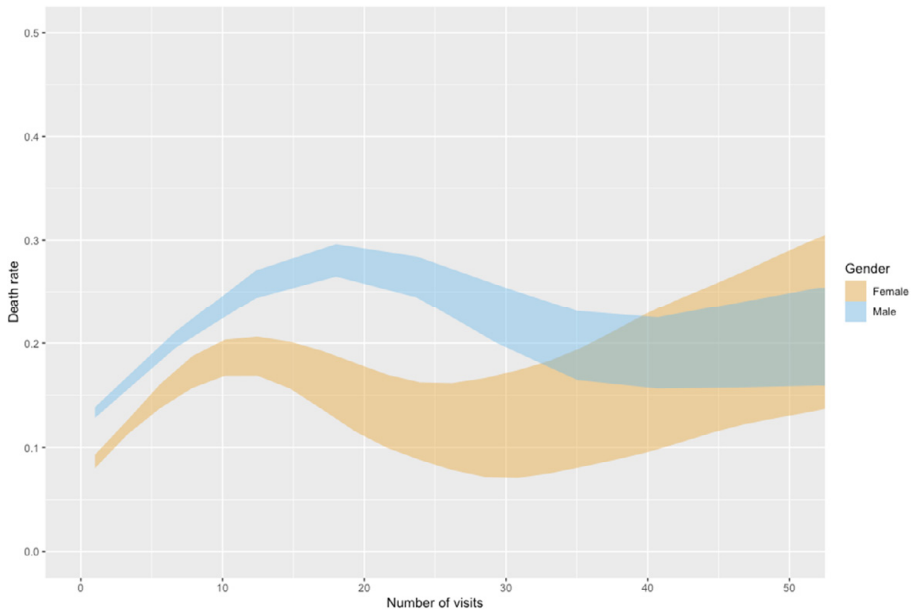
Figure 6: Death rate and number of visits for men and women, regardless of diagnosis (Svensson et al., 2022).

The findings also showed that the number of different diagnoses for substance use disorder increased the mortality risk, as did the number of visits to the emergency ward. Figure 6 shows the relationship between the death rate, the number of visits, and the patient's gender, with a significant increase in the death rate up to 12 visits for women and 18 visits for men, before decreasing.

The analysis of patient interactions with the emergency ward presented in Paper III shows how mortality risk emerges over time, which could support a system-level understanding of patient safety. Micro-level interactions have

consequences that can be visualized at the meso level, resulting in emergent patterns of risk (Figure 7). Patient safety managers could use this knowledge. The inclusion of risk factors in electronic medical records could offer an opportunity for adaptive patient safety, through increased assistance for clinical doctors and nurses. The study showed that a system-level understanding of patient visits, using data that can be accessed from the healthcare provider, could increase the potential for more patient-centred healthcare.

Both Papers II and III left unanswered questions regarding how the emergency ward continued to deliver healthcare despite the long-term increase in patient visits, notably regarding how the ward was able to adapt when stressed.
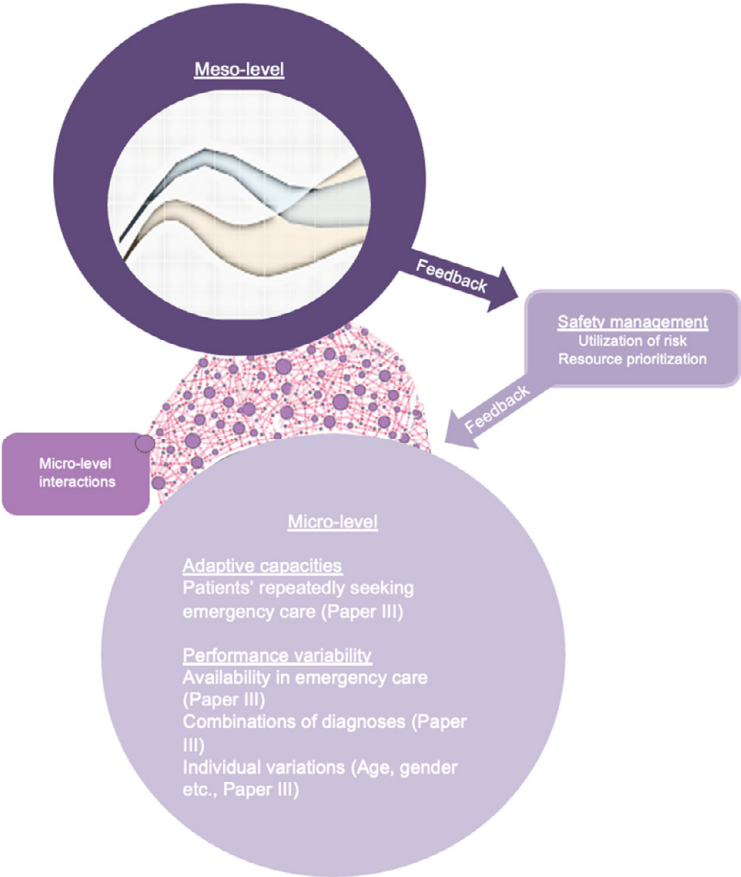

Figure 7: Conceptual schema of the research reported in Paper III.

Paper IV

Paper IV shows how patterns of patients' visits can be used by the healthcare provider to map organizational pressure over time, and understand how this creates risks within the system. A case study was conducted using patient visits to an emergency ward for substance use disorder, and a mixed methods sequential explanatory design was used that included discussions with experts, a focus group and a statistical analysis of patient visits.

The results revealed increasing demand that was approaching the ward's own definition of its maximum capacity. A total of 157,200 patient visits, during the period 2010–2020, were analysed. The perception of an increasing workload was confirmed by an increase in the percentage of patients with a diagnosis of psychosis: from an average of 1.75% to almost 5% during the studied period. At the same time, front-end workers stated that overcrowding caused frustration and dissatisfaction among patients, frequently ending in conflict between both fellow patients and staff. There was a risk of violence and further deterioration of the working environment. It should be noted that while the premises remained the same during the studied period, the number of patient beds increased from seven to nine in 2014. The organization had kept no records of the number of nurses, doctors or nurse-assistants during the studied period.

Front-end workers defined 'stressed' conditions as having to assess 55 patients in one day. Figure 8 indicates that there has been a steady increase, and that such stressful situations are becoming normal. Stressed conditions could be due to various factors, such as high patient volume, limited staffing, and having to diagnose complex cases, and the study indicated that potential consequences included a delayed or incorrect somatic diagnosis, and a lack of follow-up care. The study also identified that adaptive capacities were used to cope with the increased pressure. This could be interpreted as a sign of resilience among front-end workers.
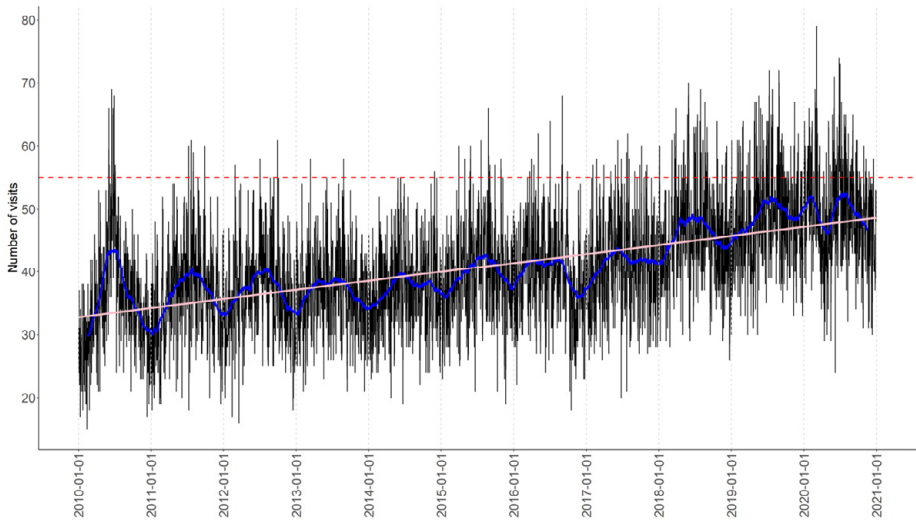
Figure 8: The number of patients visits per day over the studied period. The horizontal red dotted line shows estimated maximum capacity. The blue line is the moving average, and the pink line is the trend (Svensson 2023).

The results from Paper IV indicate that an increasing workload can be anticipated at the system level, and the emergence of risk on the ward. These findings contribute to the understanding of risk as a non-static property, as the increasing demand for healthcare highlights emerging patient safety risk. The study suggests that risk awareness should be continuously monitored over time, based on sources of risk defined by clinical front-end workers. The pattern of presented conditions also changes over time, and healthcare managers need appropriate tools that can detect and respond to factors that may increase risk – such as the expected workload, overcrowding, staffing or bed shortages. Patient safety measures include creating capacity to identify increased organizational risk over time.

The results of Paper IV highlight both micro-level adaptive capacities and performance variability, both of which have consequences at the meso level, and result in emerging patterns of risk (Figure 9).
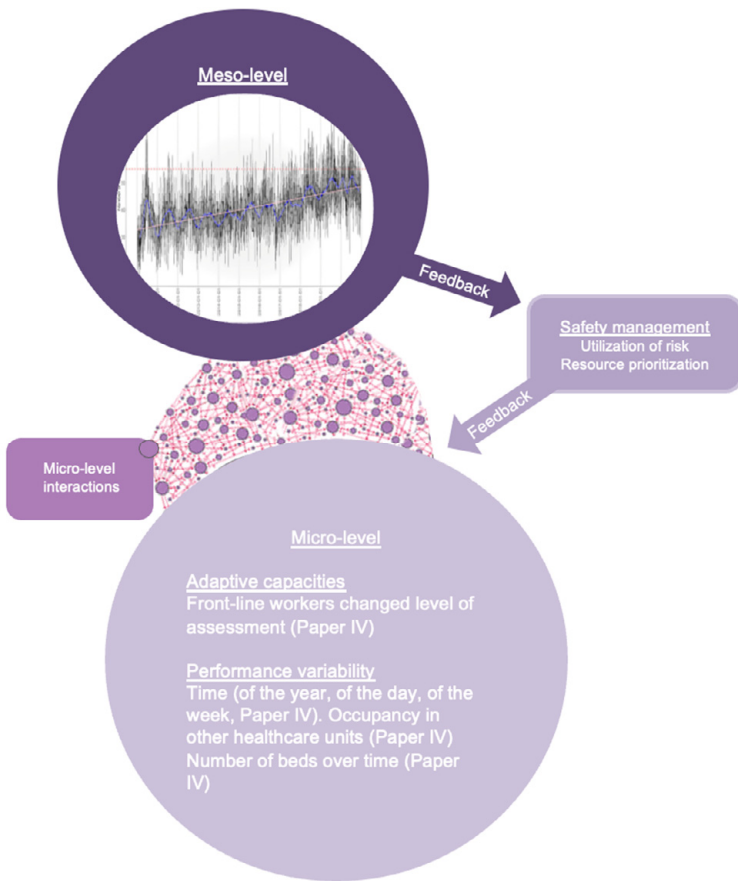
Figure 9: Conceptual schema of the research reported in Paper IV.

Discussion

In this section of the thesis, I address the research questions and discuss how my studies have contributed to patient safety research. I divide my synthesis of the overall research contribution into five sections. First, I discuss the emergence of risk and safety, as this constitutes one of the main contributions of this thesis. Second, I address the implications of the research questions for safety science and for psychiatric patient safety management. Third, I introduce possible applications to patient safety management. The fourth section focuses on a methodological reflection on the contents of this thesis, and I end with a discussion on how patient safety in psychiatry can be developed to keep up with contemporary times.

The aim of this thesis is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach. This aim was addressed by the following two main research questions, the second with three sub-questions:

Research question 1: How does the current construct of patient safety in psychiatry reflect contemporary safety science?

Research question 2: How can we understand emergent risk at the meso level based on patient visit patterns to a psychiatric healthcare facility?

  a) How can retrospective patterns of discharge be visualized to analyse everyday system variability, and adaptive capacities, over a longer time period?

  b) How does the probability of dying vary with the number of visits to an emergency ward for substance use disorder as a function of age, gender, and diagnosis for substance use?

  c) What are the practical consequences for patient safety when conditions are stressed, and what constitutes stressed conditions in an emergency ward for substance use?

The emergence of risk and safety in psychiatric healthcare

Unlike the experienced nurse or doctor, a graduate student who is spending their first day working in a psychiatric ward is unlikely to see the danger when a patient says that he recently lost his job, has no friends or family, and that he wants to be discharged because his depression isn't getting any better. Why is that? The perception of risk lies in the eyes of the beholder. Experiences and frames of reference shape the perception of risk. Risk assessments in psychiatric healthcare are a part of everyday work; nevertheless, even if risk factors for violence (Sloan, 2001; Swartz et al., 1998) or suicide (Chu et al., 2017) are well-studied, they also come with great uncertainties (Fröding, 2022). Furthermore, in a system such as the Swedish psychiatric healthcare sector, which is under significant pressure, information collected during any given visit only gives a partial and incomplete understanding of a particular patient's history and journey through the system. These factors motivate the search for new methods and techniques to support front-end workers in their day-to-day work of assessing the emergent and dynamic risks of their patients who may suffer future harm.

The starting point for this thesis was to investigate the dynamically changing risk landscapes in psychiatric healthcare, using retrospective data on system variability. Based on the analytical starting point (holism) that healthcare is a complex system with everchanging conditions and hidden interactions, which unfold in an unpredictable (external and internal) environment (Wears & Sutcliffe, 2019), new risks will always emerge, and old patient safety strategies will fail (Hollnagel, 2004). Papers II, III and IV address the theory of risk and safety as emergent properties of normal day-to-day system interactions (Hollnagel et al., 2006). These studies illustrate how a healthcare organization can monitor and anticipate dynamically changing risk. They can also be seen as a contribution to studying patient safety using a holistic approach.

Even though these three studies identified risk factors, the research was conducted within a normally functioning healthcare organization. Answers to the question 'why does it continue to work?' are found by understanding that risk and safety originate from the same adaptive strategies deployed in variable conditions (Dekker, 2014b; Dekker & Pruchnicki, 2014; Hollnagel et al., 2006). Analysing patterns of risk in a real-time environment is not new in itself, as it has been used in, for example, the oil and gas industries under the label

'adaptive risk management' (Bjerga & Aven, 2015). However, the analyses presented in Papers II, III and IV contribute to developing a new perspective for understanding the dynamics of patient safety patterns in psychiatric healthcare.

Traditional methods for analysing risk (e.g. adverse event investigations) tend to fail to capture gradually changing patterns (a migration towards the boundary of safe operations) as they only provide a snapshot of current constructions of risk (Amalberti et al., 2006; Dekker, 2011; Vaughan, 2016). By adopting an approach where risk and unwanted outcomes are continuously expected, healthcare can develop a more effective patient safety organization that is able to adapt to gradually changing risk. Seeing risk as dynamic, rather than static has several consequences: first, risk assessments are based on a patient's history, and their previous interactions and relations with the healthcare system itself (Paper III); second, the patient is seen as a source of adaptive capacities with implications for resource allocation (Paper II); and third, there is an understanding that gradually changing pressures on the healthcare system affect its adaptive capacities (Paper IV).

As safety and risk are emergent properties of a vast number of interactions and relations, rather than a product of individual actors' behaviour or actions (Leveson, 2002), patient safety in psychiatry cannot be entirely based on correcting malfunctioning components (Svensson, 2021). This means that the psychiatric healthcare organization could analyse and act on risk signals detected from the interactions and relations that make up the system. In this thesis, I use a case study to illustrate different approaches to analysing the emergence of risk. The results of Paper II, Paper III and Paper IV suggest that dynamic patterns of risk could be analysed from data related to everyday work, and the results communicated to the clinic, so that it can carry out adaptive actions. Emerging patterns of micro-level adaptation are analysed in Paper II, the consequences of risk for the patient are analysed in Paper III, and the consequences of risk for the ward (and the patient) are analysed in Paper IV.

Addressing the research questions

The emergence of risk creates incompatibilities between different levels of aggregation: what happens on one level has implications for another. This thesis aims to understand patient safety risk as an emergent property, and how

risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach. Patient visits are used to understand emergent risk at clinic, patient, and ward levels. This could support people to understand the conditions under which they operate—in other words, emergent patterns of risk—and contribute to people's adaptive capacities (Rasmussen, 1997).

Research question 1

Paper I addresses the first research question; *How does the current construct of patient safety in psychiatry reflect contemporary safety science?* A review of the current literature describing psychiatric patient safety strategies was carried out, and contrasted with contemporary safety science. By mapping suggested patient safety strategies from the literature into themes, a picture of the concept of patient safety was created. These strategies identified in the literature, their reported outcomes, and key findings created an understanding of how patient safety and risk are seen in the psychiatric literature.

The analysis highlighted that patient safety in the psychiatric literature is mainly constructed using a reductionist approach. The notion of preventability (implicitly or explicitly) guides recommendations to strengthen patient safety and reduce patient harm (Svensson, 2021).

Implications for safety science

The review found that the psychiatric literature often describes risk as a static property, and proposes measures to minimize or eliminate this risk. In contrast, contemporary safety science criticises such concepts, and risk is rather considered as emergent and dynamic (Amalberti et al., 2006; J. Rasmussen, 1997). The review concluded that strategies to increase patient safety in psychiatry are mainly based on reductionist models, with a focus on minimizing failure. This perspective neglects relevant insights based on the consideration of successful outcomes in healthcare (Hollnagel et al., 2015; Wears et al., 2017; Wiig, Braithwaite, & Clay-Williams, 2020), and the balancing act of adapting controls based on what people need (Provan, Woods, Dekker, & Rae, 2020). Safety in psychiatry could support performance variability, where continuous adjustments are created based on the dynamics of real-time conditions (Svensson, 2021).

The notion of patient safety in psychiatry does not always address aspects of preventable harm, but even if that was the case, the scoping review demonstrated that arguments in favour of preventability can be supported using

a variety of measures. The review also identified a belief system in which patient safety is maintained through the performance of front-end workers and their compliance with regulations. Fundamental principles that are found in safety science, such as supportive adaptive capacities (i.e. the ability to adjust performance to changing conditions), are ignored in the broader psychiatric healthcare literature. This clear knowledge gap served as the starting point for this thesis, which makes an empirical contribution to the understanding of emergent and dynamic patterns of risk, as well as sources of adaptive capacities, performance variability and system pressure in psychiatric healthcare.

Implications for psychiatric patient safety management

The review identified a diversity of patient safety strategies in the psychiatric literature, sometimes with conflicting suggestions on how to increase patient safety (Svensson, 2021). However, patient safety measures can have undesirable effects in other parts of the healthcare system (Cook & Rasmussen, 2005; Dekker et al., 2011; Wears et al., 2017). Even if a measure can be justified by reducing one, specific quantifiable error, transferability can be a challenge, as the context and complexity of the healthcare system can create unintended outcomes. When patient safety strategies are introduced, front-end workers need close support, including a feedback system to help them make continuous adjustments to match real-time conditions. Efforts to strengthen patient safety should not be perceived as a one-time, static improvement that validates a 'safe' system. Patient safety measures would benefit from the inclusion of a dynamic ability to change over time.

Research question 2

How can we understand emergent risk at the meso level, based on patient visit patterns to a psychiatric healthcare facility?
This question was divided into three sub-questions. The rationale was to show how patient visit patterns can be used to detect emergent risk, from three different perspectives: emerging patterns of micro-level adaptation (Paper II); risk seen in terms of the consequences for the patient (Paper III); and risk seen in terms of the consequences for the ward (and, ultimately, the patient) (Paper IV).

The studies reported in Papers II, III, and IV led to a conceptualization of the research for this thesis (Figure 10). Micro-level interactions during patient visits provide space for adaptive capacities under performance variability,

which has impacts on a meso level. In other words, risk at a meso level cannot be deconstructed into one single event, instead, it is the consequence of multiple interactions (patient visits) over time. Research question 2 is addressed by a conceptual contribution, in the form of a methodology to generate meso-level patterns from micro-level interactions. Scheduled outpatient visits that instead led to emergency ward visits (Svensson & Bergström, 2020), multiple emergency ward visits and a combination of diagnoses (Svensson et al., 2022), or stressed conditions due to high patient volume, limited staffing and complex cases (Svensson, 2023), all produce meso-level patterns of risk. These patterns cannot be explained by the behaviour of the system's constituent components (Dekker et al., 2011).

Together, research questions 2a, 2b, and 2c combine to answer research question 2, through a conceptual understanding of meso-level risk as an emergent consequence of micro-level adaptive processes and performance variability (Figure 10). It is in the relationship between different levels of aggregation that emergent properties arise (Hollnagel, 2004; Hollnagel et al., 2006; Leveson, 2002). Lower-level interactions have consequences at a higher level. Papers II, III and IV outline a methodology for studying everyday performance variability and adaptive capacities that result in emerging patterns of risk. Additional studies of emergent risk can supplement the understanding of system risk using the same type of methodology; this would support front-end workers at the micro level and help to create an understanding of current risk. It can be difficult to gain an overview of risk on a micro level, but meso-level feedback can signal emergent patterns.
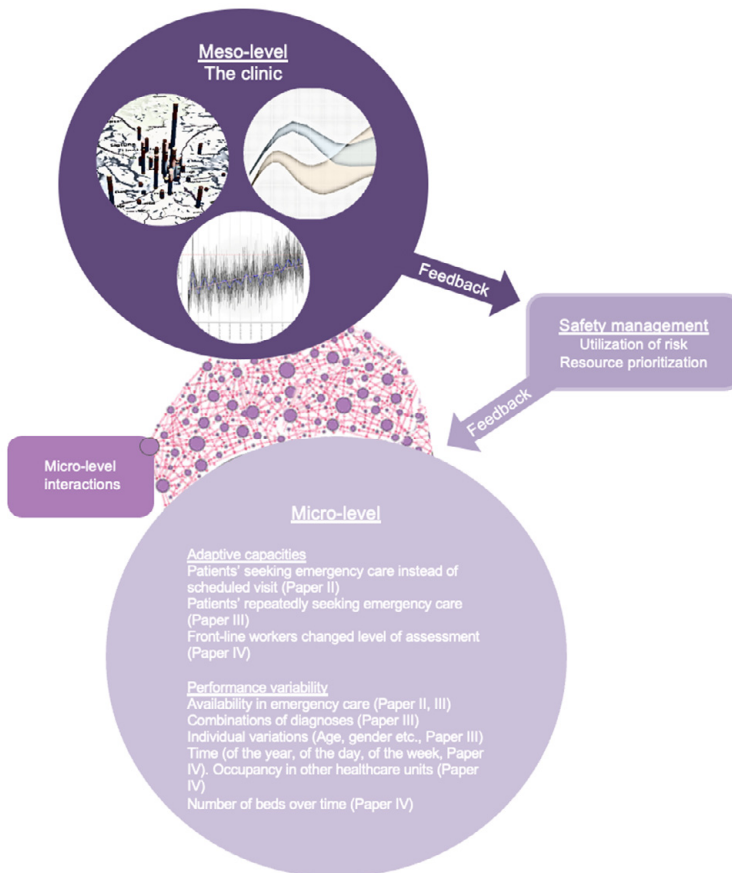
Figure 10: Conceptual schema of the research reported in Paper II, Paper III, and Paper IV.

Research question 2a

How can retrospective patterns of discharge be visualized to analyse everyday system variability, and adaptive capacities, over a longer time period?
Paper II addresses research question 2a, and challenges the perception of risk as a static property. By examining different pressures on outpatient visits or unintended emergency ward visits, the study visualizes ongoing system variability. A retrospective analysis based on a time-lapse visualization of micro-level interactions appears to have potential when analysing everyday system variability and adaptive capacities (Svensson & Bergström, 2020). The analysis uses a three-dimensional visualization tool, where geographic and

temporal data can be displayed over time. Stacked, accurately-located columns on a map are an easy method to present differences in healthcare processes—both as imagined and as done. The study's findings highlight how risk emerges within the clinic, visualized through everyday interactions.

Implications for safety science
The visualization highlighted a demand for healthcare that was not in line with the intended healthcare delivery system. The analysis identified a discrepancy between healthcare visits as imagined and as done (Hollnagel et al., 2015; Wears et al., 2015). The visualization shows demand-capacity mismatches, notably that a large proportion of scheduled outpatient visits did not occur, and patients visited the emergency ward instead. This creates an ability for managers to anticipate future healthcare visits and prioritize resources accordingly, which has been suggested as a property of resilience (Cook & Rasmussen, 2005; Hollnagel, 2013; Miller & Xiao, 2007; Wears et al., 2017).

Patient safety work in healthcare rarely addresses the clinic, management, or the system on a meso level (Bergström et al., 2015; Svensson, 2021). This situation calls for a new methodology to explore whether risk migration can be detected. Aggregated patient visits over time appear to be a promising way to identify risk emergence, as the available healthcare system has both temporal and functional variability. The findings from this study suggest that the system creates a space for both temporal and functional variability, which can be used by patients whose condition also changes (Svensson & Bergström, 2020). Patient agency is vital in order to understand and map the adaptive capacities of the system as it is the adaptive patient who uses the system's performance variability.

This study makes both theoretical and methodological contributions to the study of adaptive capacities and performance variability, and helps to understand how risk can emerge within healthcare.

Implications for psychiatric patient safety management
The findings from this study can assist patient safety by prioritising the allocation of resources according to how patient visits change over time. Visualizing interactions within a clinic could help to estimate future demand within the healthcare system, and identify patient risk if there is a lack of resources (Svensson & Bergström, 2020). An unexpected observation in this study concerned the transfer of the patient from inpatient to scheduled outpatient care. The imagined process—where all patients received treatment as an inpatient, followed by treatment in an outpatient unit—was not observed. Instead, patients visited the emergency ward and adapted their healthcare visits

according to their needs. It is clear that patients use variability within the healthcare system to meet their own safety needs.

Paper II indicates a discrepancy between imagined and actual patient visits on a system level, and offers tools to visualize this difference. However, the study leaves unanswered questions regarding the consequences of these revisits to the emergency ward, and these questions were investigated in Paper III.

Research question 2b

How does the probability of dying vary with the number of visits to an emergency ward for substance use disorder as a function of age, gender, and diagnosis for substance use?

Paper III addresses research question 2b. It uses a micro-level perspective to analyse patterns of risk and patient safety performance in psychiatric healthcare. The probability of dying varies as a function of gender, number of visits to the emergency ward, the diagnosis and the number of diagnoses. The analysis found that the death rate increased with the number of visits, up to 12 visits for women and 18 visits for men, before decreasing again. Excess mortality varied with age: 25-year-old patients had 12–22 times excess mortality, and 50-year-old patients had 8–12.5 excess mortality (Svensson et al., 2022). The study also showed that male patients had a higher mortality risk than female patients, and patients with a diagnosis of sedative hypnotics use disorder had the highest death rate in the study period.

Implications for safety science

A review of the literature on mortality for patients with substance use disorder found that this group have increased vulnerability compared to the overall population (Walker et al., 2015). By applying the concept of patient safety and risk emergence as described in the contemporary patient safety literature (Vincent & Amalberti, 2016; Wears & Sutcliffe, 2019; Wears et al., 2017), Paper III highlights an opportunity for decision-makers to identify patients at risk.

The study reveals that data from patient visits to emergency wards can be used to identify combined mortality risk factors. The results suggest that there are complex mechanisms at play that cannot be addressed using a reductionist approach, as patient safety measures require continuous adaptation (Austin et al., 2020; Wears et al., 2015). The early detection of increased mortality risk is recommended as a measure to adapt healthcare according to patient risk. The study uses patient visit and diagnosis data to detect risk, understood as a path-

dependent property of variability (Hollnagel et al., 2006; Rasmussen, 1997; Vincent & Amalberti, 2016).

Through micro-level interactions, Paper III reveals how mortality emerges over time, and supports the need for a system-level understanding of patient safety. The findings create an opportunity for an adaptive patient safety system, which includes an understanding of the system's current state, and the patient's journey within it.

Implications for psychiatric patient safety management
Research question 2b raised questions about the practical implications of how to detect patients with an increased risk of mortality. A visualization of statistical risk assessments using a decision support tool could assist front-end workers in their daily work. Alternatively, a decision support tool integrated into electronic medical records could provide them with evidence-based information about risk when triaging the patient to the required level of care. The support tool could include the patient's current diagnoses and demographics, along with their medical history. This practical patient safety system could provide a fast-and-frugal heuristic in order to make accurate decisions (Hafenbrädl et al., 2016; Love, Ika, & Pinto, 2023).

The results from Paper III suggest that more systematic use should be made of electronic medical records to identify mortality risk in patients visiting the emergency ward for substance use disorder; this finding is consistent with the literature on suicide prevention (Zalsman et al., 2016). The patient's medical history could serve as a viable resource for compiling risk factors in a user-friendly decision support tool. The number of patient visits, their diagnoses, and the number of diagnoses could be included in such a tool.

Both Paper II and Paper III indicated an increase in patient visits to the emergency ward in the long term, but did not answer questions about how the ward was able to adapt to this increase in demand for healthcare.

Research question 2c

What are the practical consequences for patient safety when conditions are stressed, and what constitutes stressed conditions in an emergency ward for substance use?
Paper IV addresses research question 2c by combining a statistical analysis and interviews. It deepens the interpretation of the studied patient visits and system pressure. The practical consequences for patient safety were both positive and negative: an increase in the adaptive capacity of front-end workers, who

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developed new skills to treat acute somatic conditions, but also an increased risk of delayed treatment.

Stressed conditions are the result of various factors, such as high patient volume, limited staffing, and complex patient cases (Svensson 2023). Paper IV highlighted an increase in patients with psychosis (from 1.75% to an average of almost 5% during the studied period), who require a high level of care and attention. The volume of patient visits was not evenly distributed during the day; although this complicated the day's planning, it eased stress as it accommodated time to recover. However, the study indicated a risk of delayed or incorrect somatic diagnoses, and a lack of follow-up care. Stressed conditions such as overcrowding have effects on patient safety, mortality, treatment delays and patient discharge (Teitelbaum et al., 2016), and are typically countered with additional front-end workers, hospital bed access, and measures that supposedly increase efficiency (Hoot & Aronsky, 2008).

Implications for safety science
The study showed that adaptive capacities to cope with increased pressure, which could be a sign of resilience, unfortunately primarily target front-end workers. This is an example of what Bergström, Van Wilsen and Henriqson (2015) discuss in their review on 'rational resilience', as resilience becomes the capacity to adapt to emerging risk in order to succeed. The results presented in Paper IV indicate that increased workload pressure can be anticipated at a system level. Consequently, management is able to plan ahead to reduce pressure at the front-end. Even though all systems have a range of adaptive capacities (Wears et al., 2017), the study revealed instances where patient reporting was blocked or delayed as a consequence of increased workload pressure. While such actions create a capacity for manoeuvre (Stephens et al., 2015), it is important to note that increasing and new healthcare demands also create an increasing risk of adverse events (Cook & Rasmussen, 2005).

Implications for psychiatric patient safety management
The findings presented in this study could support patient safety management in psychiatry, as they highlight risky situations in patient assessments. Given that healthcare is often performed under challenging conditions, a reduction in the steady increase in pressure for front-end workers is a central prerequisite for patient safety. Patients with psychosis or delirium tremens demanded the most attention and required the most resources. Trends in diagnoses (i.e. why patients seek healthcare), can be used to plan supportive interventions. Psychiatric patient safety management should not entirely rely on the ward's ability to adapt to changing demands, but provide support to cope with stressed conditions.

How can we set psychiatric healthcare up for success?

Introducing complexity thinking

The main contribution of this thesis is to suggest that a constructive way forward for future patient safety initiatives should include the perspective of 'normal' work to detect emerging risk (Svensson, 2021; Svensson & Bergström, 2020; Svensson et al., 2022). Here, the term 'normal' is used in the sense that real-world data could be used when analysing system performance.

The first research question ended in the conclusion that complexity thinking is underused; strategies to enhance patient safety in psychiatry often target individual compliance and strive to reduce performance variability (Svensson, 2021). Such actions may lead to increased regulation (Dekker, 2014a). There is a need for a shift from task-oriented approaches to a more local rationality, where front-end workers are free to decide the most sensible way to perform a task, instead of following written procedures predefined by management (Braithwaite et al., 2009; Dekker, 2019). Including degrees of freedom in written guidance could supplement local know-how, and 'normal' ways of doing things could emerge (Rasmussen, 1990). Likewise, ensuring safe variations, and helping variations to be safe through 'guided adaptability' (Provan et al., 2020) is another step towards complexity thinking. We need to understand that variation in routines and procedures is inevitable, and use our patient safety glasses to guide these adaptations. Paper IV is one example of how adaptive capacities respond to changing pressure as front-end workers have been forced to expand their competences in acute somatic treatment due to changing demands. This could be seen as an example of safety being continually adaptive in order to combat gaps under performance pressure (Patterson, Cook & Woods, 2006).

Understanding sources of variability within healthcare by monitoring everyday system variability supports the identification of increased risk for patient harm. Vincent and Amalberti (2016) argue that most safety strategies focus on improving the reliability of care and drive the development of 'optimal care'. The latter authors suggest that such patient safety strategies should be supplemented with other strategies that detect and respond to risk. Psychiatry is often performed under challenging conditions, and Paper I identified that

there is no universal patient safety strategy that works in all situations (Svensson, 2021). Its diversity and heterogeneous organization means that psychiatric healthcare uses different, sometimes contrasting strategies. Patient safety management can facilitate the safe variation of these strategies (Provan et al., 2020).

Monitoring the dynamic emergence of risk

There is a need for conceptual feedback tools that can reveal unfolding dynamics and highlight emergent risk (Wears et al., 2017). Feedback, at all levels within the healthcare system, is essential as dynamically changing patterns of risk in complex systems are not easy for front-end workers to grasp (Woods & Cook, 2002). In this context, Ahmedani et al. (2019) report the results of a case study in the United States of 2,674 individuals who committed suicide between 2000 and 2013. Their study showed that knowledge of visit patterns to healthcare, especially to the emergency ward, can be used to prevent suicide. Similar patterns have been studied in Sweden, where female and younger individuals seek healthcare and psychiatric services to a larger extent prior to suicide (Bergqvist et al., 2022). In the same way that there is no universal solution to address risk in psychiatric healthcare (Paper 1), monitoring different sources of risk offers different perspectives, as multiple narratives help to understand the emergence of system risk, or why something happened (Dekker et al., 2011).

The Swedish *Action Plan for Increased Patient Safety* suggests that there should be more support for the development of computerized data compilation and knowledge dissemination systems (Socialstyrelsen, 2021). The plan is an opportunity to introduce feedback from patient visits, and increase the understanding of performance variability, so that adaptive capacities can be used more efficiently. In this thesis, I propose further methods to view and analyse patient safety, which is in line with Swedish legislation (Socialstyrelsen, 2017, 2021). The methodology suggested in this thesis introduces new ways to analyse complexity, based on patterns of risk and performance variability in psychiatric healthcare (Papers II, III and IV). Together, a support system for feedback on emergent patterns of risk could be used to develop a dashboard to host software applications that capture relevant healthcare data. Such analytical tools could pull together data from different sources and present graphs, charts or maps to provide an insight into the system's state and emergent risk. Such techniques can enhance the detection

of the emergence of failure, and monitor changing risk landscapes. Mechanisms that provide an insight into changing risk support both the system's learning and adaptation processes (Woods & Cook, 2002).

There are studies proposing that discontinuities in care due to a loss of information or interruptions can sometimes be anticipated. Examples include inconsistencies between the drugs listed in the patient's file and the conditions reported in the patient's history (Cook et al., 2000; Fernholm et al., 2020). The analysis of patterns of patient visits can create a similar ability to anticipate risk. This point is highlighted in Paper II and Paper IV; monitoring the dynamic emergence of risk could positively impact workload pressure and resource prioritization. However, such an approach demands a rethinking of risks and benefits over longer time scales, for example, discharge planning that anticipates the patient's next healthcare visit. It could also include the patient's journey (Vincent & Amalberti, 2016), as the imagined pathway can differ from the actual healthcare visit (Svensson & Bergström, 2020). Efforts to bridge such differences could result in a more resourceful healthcare system (Cook et al., 2000).

Methodological reflection

This thesis essentially argues for the use of real-time patient data to understand risk and performance variability in psychiatric healthcare. Trends and patterns of micro-level interactions can be used to reveal the emergence of risk, which impacts the system on different levels. The thesis aims to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach. A review of patient safety strategies found in the psychiatric literature (Svensson, 2021) raised questions about how to acknowledge performance variability and the dynamic migration of risk. A case study was chosen for an in-depth analysis of patient visits to a specific psychiatric clinic, where the emergence of risk could be studied on three different levels: the system, the patient and the ward. Case studies are suited to the study of complex phenomena, and how systems change over time (Sibbald et al., 2021; Yin, 1999), and the approach was used in this thesis to reveal patterns of patient visits. The methods proposed in this thesis should be interpreted as a complement to established patient safety methods.

A case study can lack generalizability, and the results are sometimes used as a single source of evidence, as findings may not be applicable to other clinics (Yin, 1999). However, although specific results are not necessarily transferable to other settings, the analysis of patterns of patient visits has led to promising results in the context of analysing risk as an emergent property. The methodological approach used in this thesis could inspire other analyses of risk in different healthcare settings. The analysis could be modified to examine risk emergence as a function of patient demographics and offered treatments. Trends in why, and how the patient visited the healthcare setting could indicate different adaptive capacities within the system. For instance, Paper II addresses the meso level, and raises questions about why patients visited the emergency ward instead of the planned outpatient facility. It should be noted that the combination of quantitative and qualitative methods presented in Paper IV allowed a more comprehensive understanding of the phenomenon of risk emergence and adaptive capacities than either method alone.

This thesis suggests that decision support tools are a useful way to adapt to risk within a psychiatric setting. But what if the healthcare system had a tool that raised a notification when an increased risk of patient mortality was identified, as in Paper III? Would this mean that some unexpected deaths could then be considered preventable? The answer is yes from a broader, system perspective, but no with respect to the individual case. It is important to understand that this thesis does not recommend backtracking individual cases to find errors in assessments, instead it promotes an understanding of the effects and characteristics of the system. We should not use a decision support tool to look at individual cases and judge whether an adverse event was preventable or not. In practice, such an approach has been extensively criticised. Confirmation bias, the cost-benefit balance and measurable outcomes can play a significant role in what is regarded as a cause (Lundberg et al., 2010). The cause you find depends on where you look, what you look for, and your preunderstanding of similar events (Dekker, 2014b). With better decision support tools, the healthcare sector could manage patient safety risk on a system level, based on patterns of patient interactions with the system. This thesis looks at patterns of patient visits from a holistic perspective, and a discussion of preventability serves no analytical value. Patient visits are used to identify adaptive capacities and performance variability, and suggest patterns of emerging risk.

If a decision support tool could be made user-friendly, would this simply introduce another layer of bureaucracy? Outcomes from efforts to improve patient safety are not all unequivocally good. The evaluation of strategies is

shaped by people's positions, roles, relationships and responsibilities (Cribb, Entwistle, & Mitchell, 2022). Measurements provide some knowledge about healthcare, and can support comparisons across time and place. However, they may fail to capture important aspects and can, in a sense, be partial. Patient safety initiatives can both improve and undermine safety (Wears et al., 2017) and reflect normative choices (Woods et al., 2010). Complexity theory suggests that improvements based on the 'wisdom' of hindsight cannot single out and eliminate causes, since the eventual outcome of an event is non-linear and probably impossible to foresee (Dekker et al., 2011). A decision support tool should, therefore, exclude judgment-based data, and instead include data from the real world. The methodological choices described in this thesis seek to promote an understanding of how patient safety can support the healthcare organization, rather than discussing where and when something went wrong, or which actions could have been avoided.

Discussions about patient harm should consider system patterns. This may lead to a more forward-looking view of accountability, instead of a backward-looking perspective (Berlinger, 2005; Dekker, 2009), and a discussion of joint responsibility. The methods outlined in this thesis seek to inspire a discussion of what patient safety management could do for the system going forward, rather than pointing fingers and defining what could have been prevented if someone had acted differently. The methodology used in this thesis is to understand how the system can make it easier for those who work within it, both patients and front-end workers.

What is the next step for patient safety in psychiatric healthcare?

This thesis has described the emergence of risk in psychiatric healthcare, identified the lack of scientific research on this issue in the psychiatric literature, and presented three studies that illustrate how to use risk emergence knowledge to increase patient safety. Going forward, it suggests the implementation of feedback systems based on data from daily activities. Knowledge of trends, patterns, and the emergence of risk can be used to support front-end workers, increase patient safety and ultimately reduce risk for patients. Gathering data from various sources is an opportunity to understand patient safety, and why patient harm occurs (WHO, 2021). An

interesting focus for future research would be to develop an effective support system and validate its relevance for patient safety.

The healthcare system contains both small, rapid changes, and others that unfold more slowly with a more general impact, all of which are happening at the same time (Rasmussen, 1997). The arguments put forward in this thesis suggest that patient safety measures that focus on the short term will struggle to have an impact in this everchanging, complex environment, and can only create an illusion of patient safety. Future research on patient safety in psychiatry could draw upon principles of performance variability and adaptive capacities when studying identified sources of risk. The methods proposed in this thesis offer guidance on how to approach such research, for example, by providing front-end workers with a tool based on the patient's documented healthcare history, or supporting patient safety management by visualizing risk parameter data on a system level.

The large, high-quality datasets within in the healthcare sector create opportunities to detect emerging risk that could impact patient safety. The future for patient safety monitoring lies in intelligent healthcare systems. The questions to be asked in the field of psychiatric patient safety research include how generalizable a support system could be, and how to test the impact of a feedback system on patient safety risk.

Conclusions

The aim of this thesis is to understand patient safety risk as an emergent property, and how risk can be analysed using patient visits to a psychiatric healthcare facility, based on a holistic approach.

It presents several recommendations regarding how the healthcare system, in particular psychiatric healthcare, can understand and analyse patient safety risk as an emergent property of everyday interactions and relations. This view has its conceptual roots in complexity theory. The concept of 'emergence' is used to explain a mismatch between levels of aggregation in the healthcare system, notably the observation that patterns 'emerge' at higher system levels from interactions at lower levels.

The thesis uses patient visit patterns to create an understanding of emergent risk from three perspectives:

1. The organizational perspective, where emergent patterns of micro-level adaptation are analysed. Visualizing patient visits is suggested as a starting point to identify emerging risk within a healthcare organization. Patient visit patterns are identified as a driver of adaptive capacities, with implications for resource allocation within the healthcare system.
2. The patient perspective, where emergent risk factors for the patient are analysed. The findings confirm previous results which show that patients with substance use disorder suffer from excess mortality compared to the overall population. However, the research nuances how, and when that risk emerges, and identifies opportunities for early detection. A patient's previous interactions with the healthcare system can be used to detect increased mortality risk at a meso level, with implications for patient safety.
3. The ward perspective, where emergent risk for the ward (and, ultimately, the patient) is analysed. Stress to the system not only affects the unit's adaptive capacities, with implications for front-end workers, but also creates conditions for delayed or incorrect somatic

diagnoses and overcrowding. The findings suggest that increased workload pressure can be anticipated at a system level using data from micro-level interactions.

Paper I concludes that the literature on patient safety in psychiatry seldom perceives risk as a dynamic migration of daily activities. The methods used in Papers II, III, and IV illustrate how patient visit patterns can be used to analyse emerging risks in the healthcare system. This supports an understanding of how patient safety risk is dynamic and changes over time.

The conceptual framework presented in this thesis seeks to map sources of adaptive capacities and performance variability, and the risk that emerges from their interactions. This knowledge can be used to create new forms of feedback from the meso to the micro level. One example is electronic medical records, which, in turn, could create better conditions for patient safety. Patient safety management should acknowledge the possibility of system migration, and use visit patterns to strengthen patient safety. Data on risk parameters from patient visits are an opportunity to adapt decisions according to the system's state. This is the next step in increasing patient safety.

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